ESTABLISHING A DEPARTMENT OF DEFENSE PROGRAM MANAGEMENT BODY OF KNOWLEDGE

THESIS

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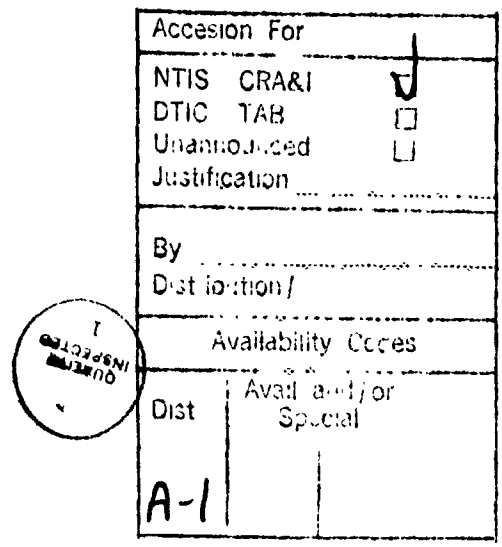

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Presented to the School of Systems and Logistics

of the Air Force Institute of Technology

Air University

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Master of Science in Systems Management

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Preface

The purpose of this research project was to develop a body of knowledge for the field of acquisition program management in the Department of Defense (DoD). The Defense Body of Knowledge (DBOK) is a compilation of all knowledge areas that a program manager must know and understand to be effective. By defining the knowledge requirements the DBOK is the necessary first step toward establishing DoD acquisition management as a profession.

This research used four methods to develop and validate the DBOK: 1) an exhaustive review of literature on the field of project management, 2) curricula review of educational institutions in the DoD that teach defense acquisition management, 3) expert review, and 4) a survey administered to the recognized experts in the field. The resulting DBOK is a validated foundation of the acquisition program management profession, but continuing review and development is necessary to ensure that it is accepted across the profession today and in the future.

The researchers took counsel from several people; without their help the DBOK would not have been developed. Primarily we would like to thank our advisor, Dr. Curtis "Don't Call Me Sir Anymore" Cook at the Project Management Institute, for his direction and patience throughout this project. Finally, the DBOK would not have been possible without the efforts of Dr. Owen Gadeken at the Defense Systems Management College; to him we are indebted.

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Abstract

This research project developed a common body of knowledge for the field of acquisition program management in the Department of Defense (DoD). The Defense Program Management Body of Knowledge (DBOK) is a compilation of all knowledge areas that a program manager must know and understand to be effective. Three methods were used to develop a hypothetical model DBOK: 1) an exhaustive review of project management literature, 2) curricula review of DoD acquisition management educational institutions, and 3) expert review. The hypothetical model was validated with a survey administered by the Project Management Institute to all directors and deputy directors of Major Defense Acquisition (Category I) programs in the DoD. Of 148 surveys mailed, 53 were returned for a response rate of 36%. The survey results prioritize all elements of the DBOK and identify acute training needs of the respondents. The resulting DBOK is a validated knowledge baseline for the acquisition program management profession. As such, it is a suitable standard for accrediting DoD program management educational institutions that teach DoD program management, and for certification of program managers across the DoD. The DBOK must now be subjected to professional review and criticism to ensure its continuing applicability and acceptance throughout the profession.

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I. Introduction

General Issue

The Department of Defense (DoD) is one of the most complex organizations in the United States. It employs nearly 10 million Americans (almost 10% of the total American workforce), executes over 50 million contracts per year, and spends between $250 and $300 billion annually. The goal of this effort and spending is the development and ultimate deployment of some of the most unique and complex systems in the world (12:5).

Acquiring and deploying systems with the size and complexity required by the DoD poses unique and difficult problems for the DoD program manager. In order to effectively meet and counter these problems, DoD program managers must be experienced, well-trained, and educated. Deficiencies have been noticed, however, in both the education and training of the DoD acquisition workforce. Due largely to these deficiencies, system schedules and costs have been underestimated, stated requirements have not been adequately met, and the American public has begun to doubt the ability of DoD to effectively acquire needed

systems. This public doubt is not without substance for, in general, DoD has not developed and maintained a project management workforce which possesses the acquisition-related education and training required to solve the unique acquisition problems facing the DoD today (12:31-39).

One major reason for the noted deficiencies in both the training and education of DoD project managers is the lack of a common DoD project management body of knowledge (DBOK). To date, there is no standardized, comprehensive listing or publication of the information an individual must know and understand in order to perform effectively. As a result, no DoD-wide project management certification program exists, although some services do have specific certification programs. A comprehensive body of knowledge would provide DoD with the baseline for developing a professional workforce which is well-educated and possesses the information needed to perform effectively.

Objective

The objective of this paper is to define and validate a defense-specific project management body of knowledge which is sufficiently comprehensive to include those project managerial practices which every professional DoD project manager must know and understand in order to perform effectively.

Scope of Research

This thesis will define the knowledge necessary for a DoD project manager to perform effectively. A list of knowledge areas will be developed, then validated by soliciting input from all directors and deputy directors of major DoD acquisition programs. Their input will be cross-referenced with the original product and changes will be made where appropriate.

II. Background

Introduction

This section will discuss the field of project management from the perspectives of the project manager, the organizational structure within which project management operates, and the history of project management. Finally, the profession of project management will be discussed. To begin this section it is necessary to define the "project."

Definition of a Project

Since project managers are concerned with the management of projects, it is essential that one adequately understands what a project is, and what makes a project unique from other management endeavors, before trying to unravel the complexities existing for the effective project manager.

Acquiring a sound and thorough definition of a project is in itself a difficult task, for, like any abstract concept, various authors and experts in the field of project management define the term in a variety of ways. For example, Kerzner, in his text Project Management: A Systems Approach to Planning, Scheduling, and Controlling, defines a project as:

Any series of activities and tasks that:

- Have a specific objective to be completed within certain specifications
- Have defined start and end dates
- Have funding limitations (if applicable)
- Consume Resources (i.e. money, people, equipment). (14:2-3)

Meredith and Mantel, in their text Project Management: a Managerial Approach, present a much more in-depth definition of a project then does Kerzner. Meredith and Mantel break a project into three separate phases, consisting of Project Initiation, Implementation, and Termination (19:10-11). Another definition can be gained from Dr David Cleland, in his text Project Management Strategies: Design and Implementation. Here Dr Cleland defines a project as:

> ...any undertaking that has definite, finite objectives representing specified values to be used in the satisfaction of some desire...a project consists of a combination of organizational resources pulled together to create something that did not previously exist and that will provide a performance capability in the design and execution of organizational strategies. A project has a distinct lifecycle, starting with an idea and progressing through design, engineering, and manufacturing or construction through use by a project owner. (4:11-12)

Other sources will define the project differently, but the essence of each definition is the same. The definition of a project which captures this "common essence" in a manner most easily understood comes from the Project Management Institute's (PMI's) Project Management Body of Knowledge (PMBOK). The PMBOK's definition of a project is as follows:

> Any undertaking with a defined starting point and defined objectives by which completion is identified. In practice, most objectives depend on finite, or limited resources, by which the objectives are to be accomplished. (21:1•1)

From this definition it can be seen that an essential element of any project is to bring about change and project managers must, in turn, effectively manage that change. Because of this continuous change, the management of projects is especially difficult. In order to be effectively conducted, the task must be accomplished by a trained and experienced professional: the project manager. Cleland states that project management is an approach for responding to the dynamic nature of the project throughout it's lifecycle in an organization. To deal with complex projects, tailored strategies are required that are often simple but are rarely obvious to the manager. To develop such strategies, and to solve subsequent problems, there is a need to develop management techniques and devices which address themselves to the dynamic nature of projects (4:34). From here it can be seen that the simplest definition of the project manager's role understates the true responsibilities and duties of the project manager. A much more in-depth definition is required.

The Role of the Project Manager

In order to define the project manager's role one must first identify the functions that a project manager is responsible to accomplish during the lifecycle of the

project (1:13). Kerzner states that a project manager is not only the manager of change, but is also a planner, monitor and controller of his respective project. This includes the following:

- Complete task definition
- Resource requirement definition
- Major timetable milestones
- Definition of end item quality and reliability (16:17)

Meredith and Mantel further this definition by including administrative responsibilities, budgeting, staffing, organizing, and coordinating project matters to the list of responsibilities of the project manager (19:88). During the 1976 Seminar of the Project Management Institute in Houston, Texas, the important functions of the project manager were defined as:

- Planning and Scheduling
- Performance Analysis
- Progress Reporting
- Maintaining Client/Consultant Relations
- Project Trend Analysis
- Cost Trends Analysis
- Logistics Management
- Cost Control
- Organization and Manpower Planning
- Maintaining the Technical/Business Interface
- Contract Administration
- Controlling materials and Manpower
- Estimating and Procedure Writing
- Administration (1:13)

Although none of these lists is comprehensive, it can be seen that the project manager has a variety of responsibilities and is the central point around which the project revolves. With this in mind, and using information

from the experts in the field for guidance, a definition of "the project manager" can be attempted. Adams, in his pamphlet, "*Roles and Responsibilities of the Program Manager*," defines a project manager as a multi-dimensional person who possesses skills which include, but are not limited to:

> ***Integrator***: Since the project manager is the only person who is able to view the entire project and see how it is to fit into the overall plan of the organization, it is essential that the project manager coordinate all the efforts of his team into a workable unit towards accomplishing the project goals. The project manager must "integrate" the work being done within with the work being done outside the organization to ensure success and compatibility.
>
> ***Communicator***: Information comes to the project manager from various sources and the project manager must be able to funnel this information, in a manner understandable to the team members, in order to ensure success.
>
> ***Team Leader***: The project manager must be able to solve problems as they arise and to guide people from different functional areas towards the accomplishment of the project goal.
>
> ***Decision Maker***: Decisions will vary according to the type of the project and the lifecycle stage, but the project manager must make them.
>
> ***Climate Creator or Builder***: An atmosphere must be created in which the team members can work together without hinderance. It must be supportive and conflicts and unrest must be avoided. (1:15-16)

Another definition of the role of the project manager is given by Kerzner who states that, "A project manager is one who plans, schedules, directs and controls company resources for a relatively short period of time during which

established and specified goals and objectives are being accomplished" (14:2).

From these definitions it can be seen that the project manager is in charge of total project planning and monitoring including such items as:

- Project Planning
  - Defining work requirements
  - Defining quantity of work
  - Defining resources needed
- Project Monitoring
  - Tracking progress
  - Comparing actual to predicted progress
  - Analyzing impact
  - Making adjustments

  (15:2-3)

"Successful" project management can therefore be defined as applying resources to reach the project objectives:

- Within time
- Within budgeted cost
- At the desired performance/technology level
- While satisfying customer or user expectations of quality

(15:3)

These criteria are displayed in Figure 1.

Project Organization

Project management uses a systems approach in which functionally organized personnel (vertical Hierarchy) are assigned to a specific project (horizontal hierarchy) as shown in Figure 2 (14:2). Such a structure is commonly referred to as a "matrix" structure. The typical preferred relationship between the project manager and the functional managers is shown in Figure 3. The functional

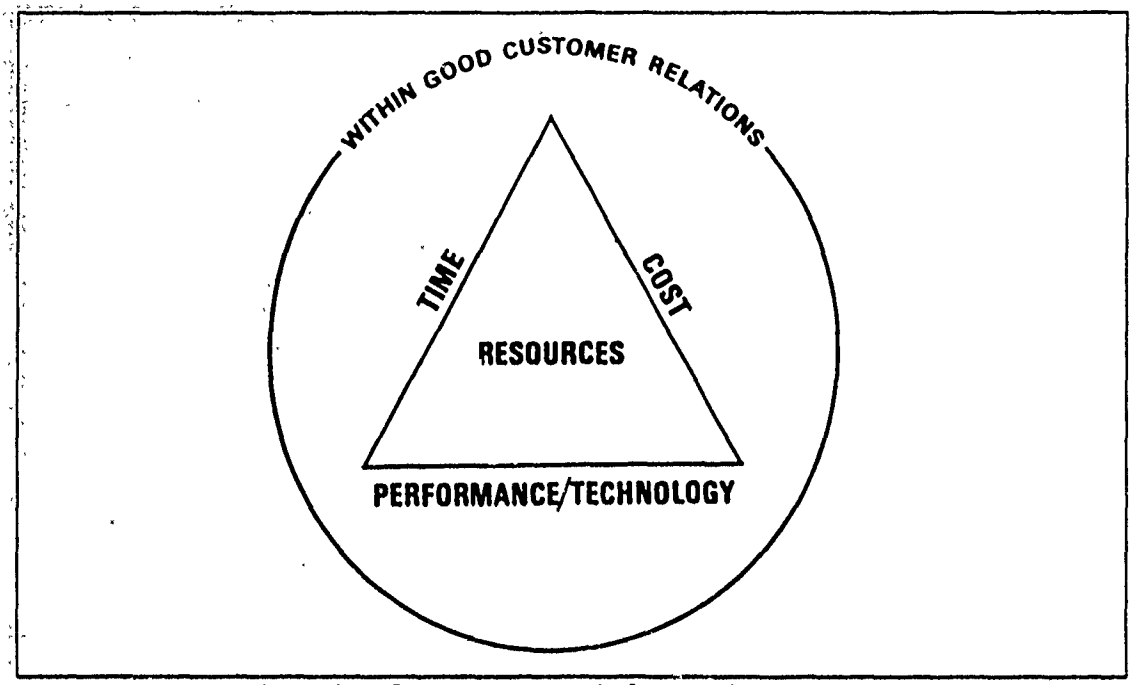

FIGURE 1: Criteria for Successful Project Management. (16:5)

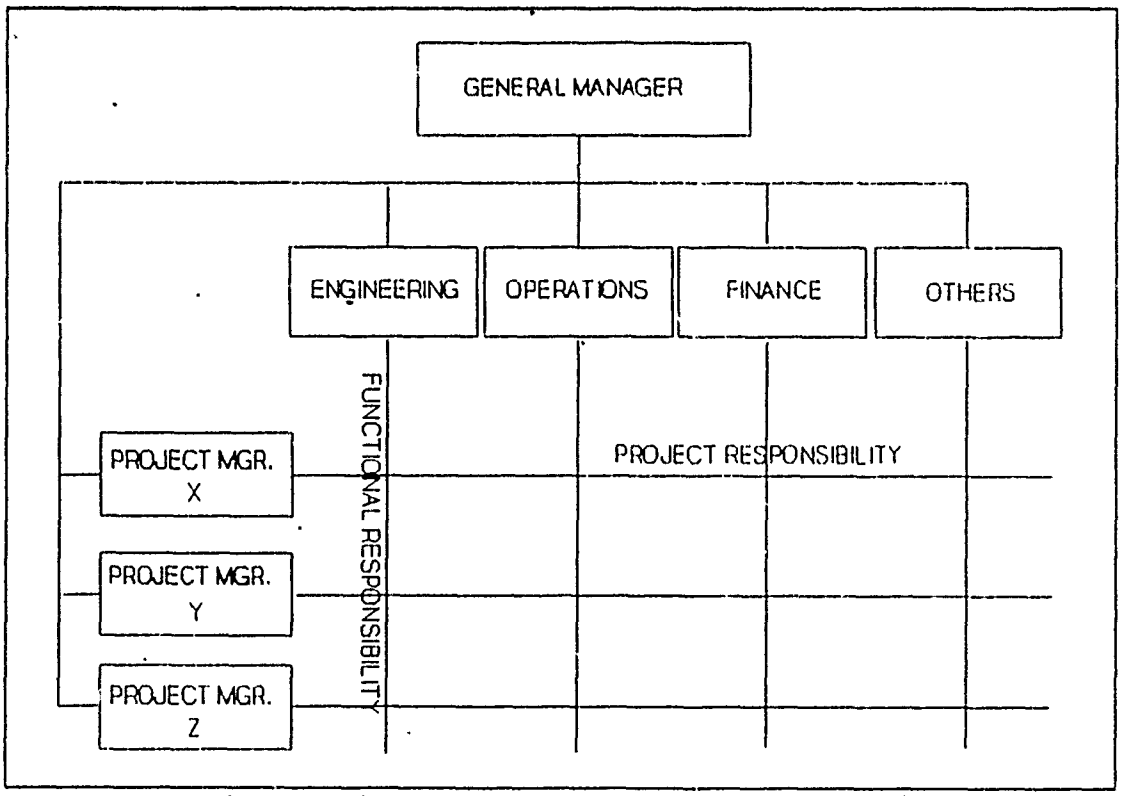

FIGURE 2: The Matrix Organizational Structure. (16:116)

manager is usually the technical expert, relied upon by the project manager for guidance and assistance.

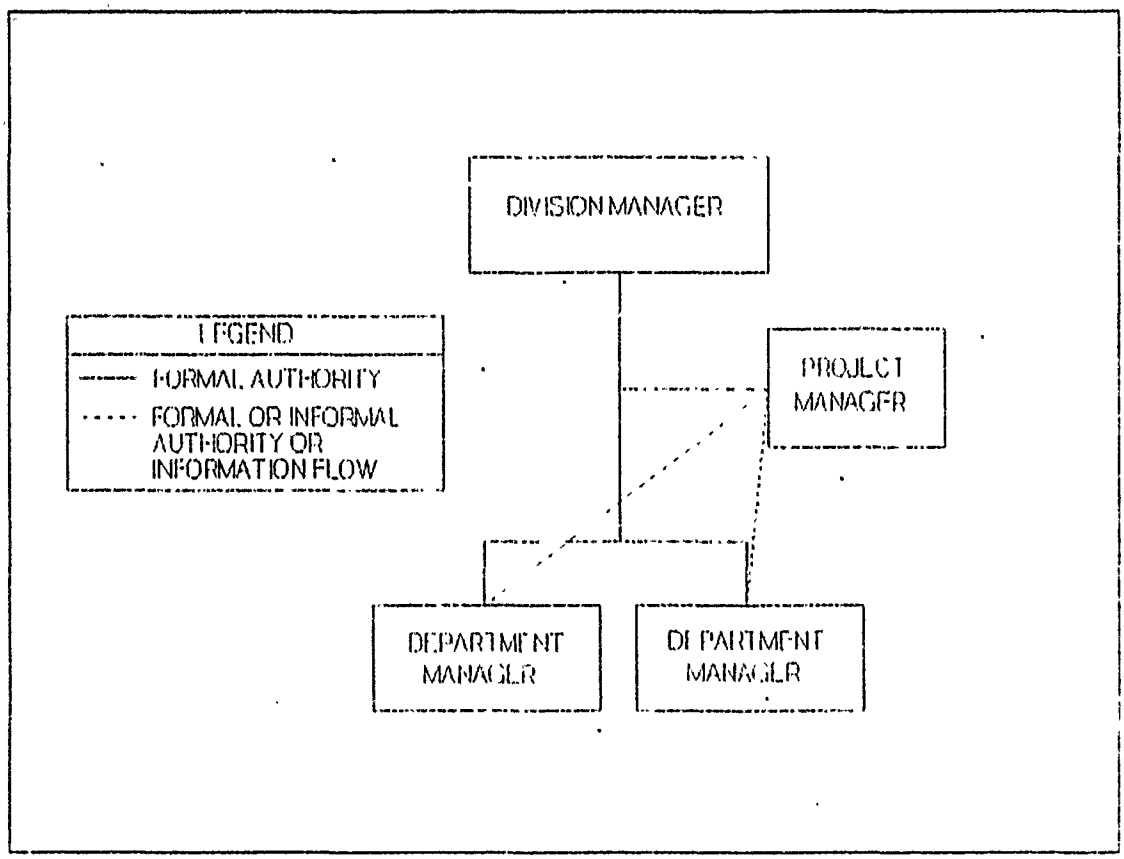

FIGURE 3: The Relationship Between the Project Manager and Functional Managers. (15:112)

Resources. The total resources available to the organization are money, personnel, equipment, facilities, materials, and information/technology (16:7). Despite the project manager's span of control over the project, he typically controls none of these resources. The project manager only identifies the resource requirements of the project. The functional managers and top management

maintain control over the resources of the organization and assign them to the project. The project manager must therefore negotiate with the functional managers and top management for project resources. This relationship is illustrated in Figure 4 (16:10).

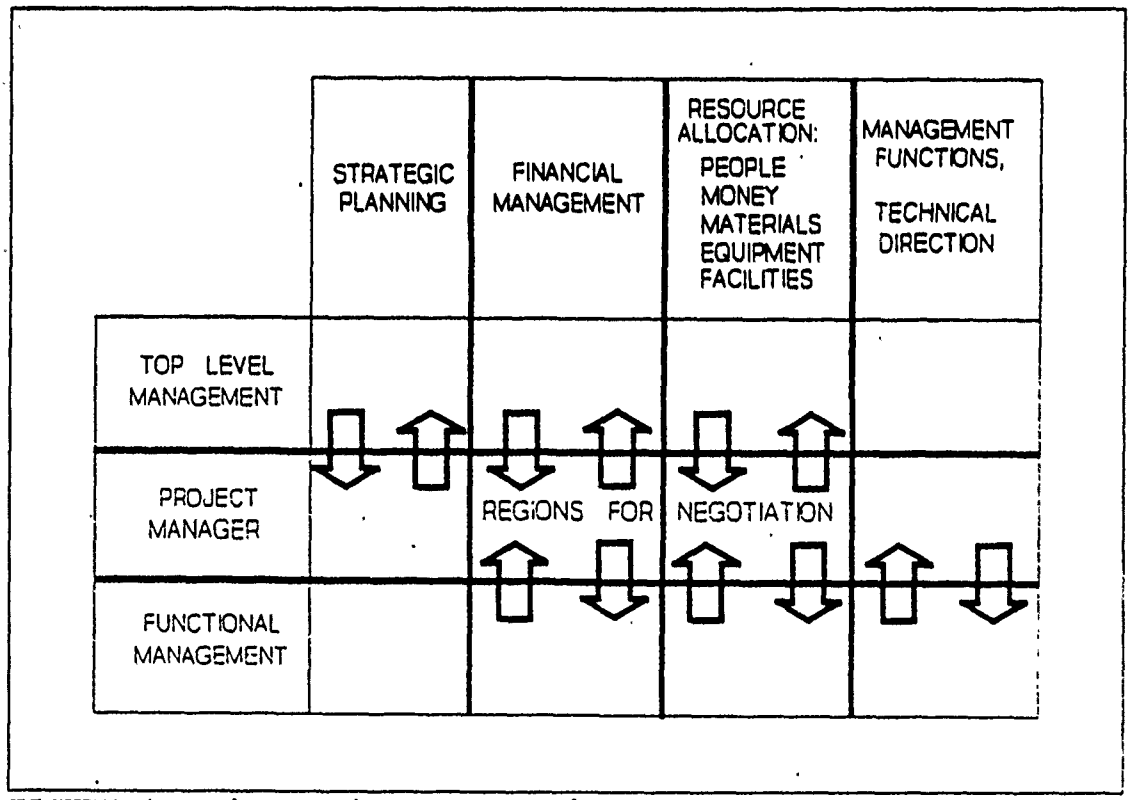

FIGURE 4: The Project Manager's Negotiating Activities. (15:11)

Project Personnel. When the resources in question are the members of the project team, the project manager's authority is delicately balanced with that of the functional managers who retain ultimate control over their people. The exact balance varies between organizations and even between

individual managers within organizations, but the common theme is duality. Each member of the project team works for two bosses. The functional managers may write performance evaluation reports and control compensation, while the project manager directs the daily tasks of the team (19,121).

Based on the above characteristics of the matrix organization, the successful project manager depends strongly on:

- Good daily working relationships with the functional managers who directly assign resources to the project and provide technical guidance to the project manager.
- Communication skills. The project manager must deal with others and effectively manage various interactions at all levels through effective communication skills. (4:21)
- Negotiating skills for soliciting project resources. As Meredith and Mantel put it, "Success is doubtful for a PM without strong negotiating skills." (17:121)
- Motivation skills to encourage quality output from subordinates of other managers. (19:91-92)

Evolution of Project Management

Project management is not a new concept. Establishing a project as a means to an end has been around for thousands of years (21:Foreword). Both the Pyramids of Egypt and the Great Wall of China can be cited as early examples of projects. These were no doubt prolonged and complex activities which exhibited many managerial and production difficulties.

What is new to the field of project management is the rapidly changing business environment. The field of project management today is a much more complex and diverse discipline then it was in the past and because of this it is even more essential now, than it has been in the past, that this change is brought about as effectively and efficiently as possible (21:1•1). To help accomplish this, project management has many innovative approaches to both management restructuring and the adoption of special management techniques (14:1).

The Changing Management Environment. Four trends have led to the advent of project management. These trends are:

1. Increasing rates of technical innovation, its dissemination and adoption, which tend to decrease the life cycle of the production process.

2. Price/Profit reductions from increased competition and technological complexity.

3. Increase in the demand for trained and experienced professionals and specialists in all phases of the project lifecycle.

4. Decreased timeframe in which to accomplish the project successfully. (20:2)

In response to the trends mentioned above,

> ...management was "forced" into organizational restructuring because the traditional organizational form which had survived so many decades was now found to be inadequate to integrate activities across functional boundaries. (14:19)

These functional boundaries, when superimposed on the "prestige" gaps between management layers, create operational islands within the firm which operate

autonomously and/or hoard information for fear of losing power. Figure 5 illustrates this problem. Restructuring into a project approach was usually successful at integrating these operational islands back into the firm. (14:19-20)

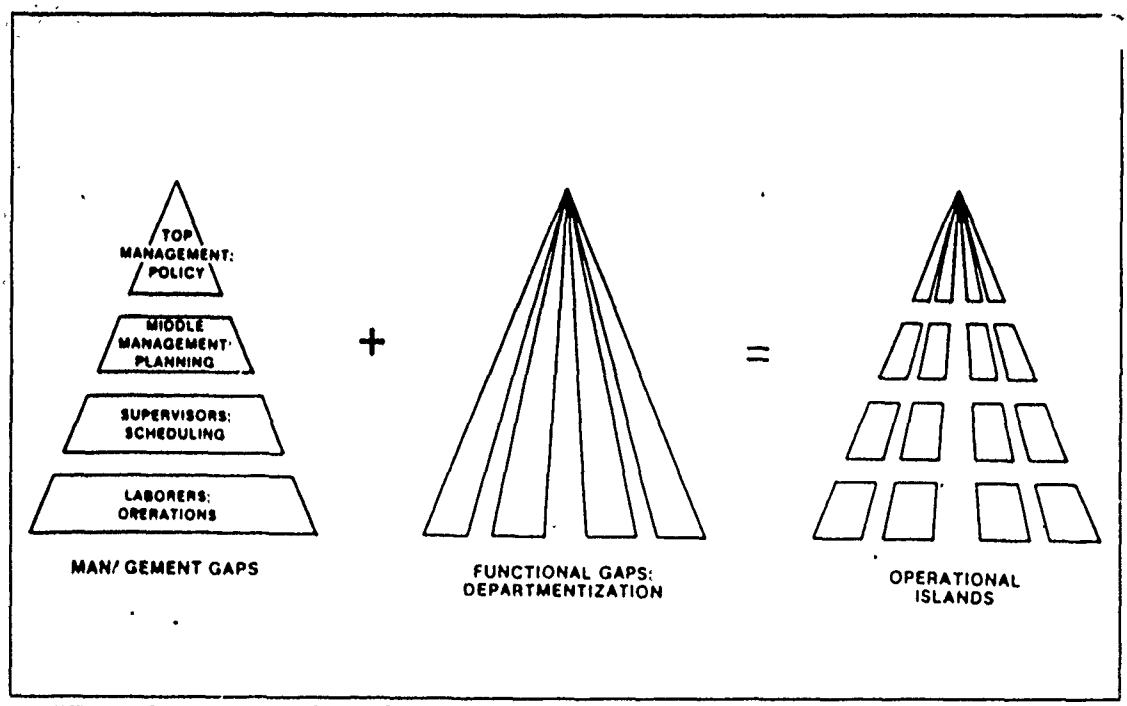

FIGURE 5: Operational Islands in Traditional Organizational Structures. (16:5)

Advantages of Project Management. As a result of the four trends mentioned above, four additional forces drive organizations toward the employment of project management:

1. The rate of change within the business environment is increasing and project management is more responsive and adaptable to this change than other management paradigms.

2. Increased complexity allows the project manager to effectively use the expertise of many people from various disciplines.

3. The project manager is able to focus his attention on the project and thus is able to minimize the amount of risk present throughout the lifecycle of the project.

4. Project management allows for successful allocation of limited resources. (20:2-3)

Project management is, therefore, an effective response to the changing business environment that faces many firms.

The traditional organizational structures, exemplified by Figure 6, were not able to cope with the rapid rate of change in both technology and the market place which has characterized the past twenty years. This rate of change has created enormous strains upon existing organizational forms. The traditional management structure is highly bureaucratic, and experience has shown that it can not respond rapidly to a changing environment. Thus the traditional structure must be replaced by project management, or temporary management structures that are highly organic and can respond very rapidly as situations develop inside and outside the company. (16:102-106)

Project management is a way to integrate complex efforts and to reduce bureaucracy. It provides a means to ensure both flexibility and control.

The need for flexibility has become apparent since no two projects are ever alike from a manager's perspective. There are always differences in technology, in geographical

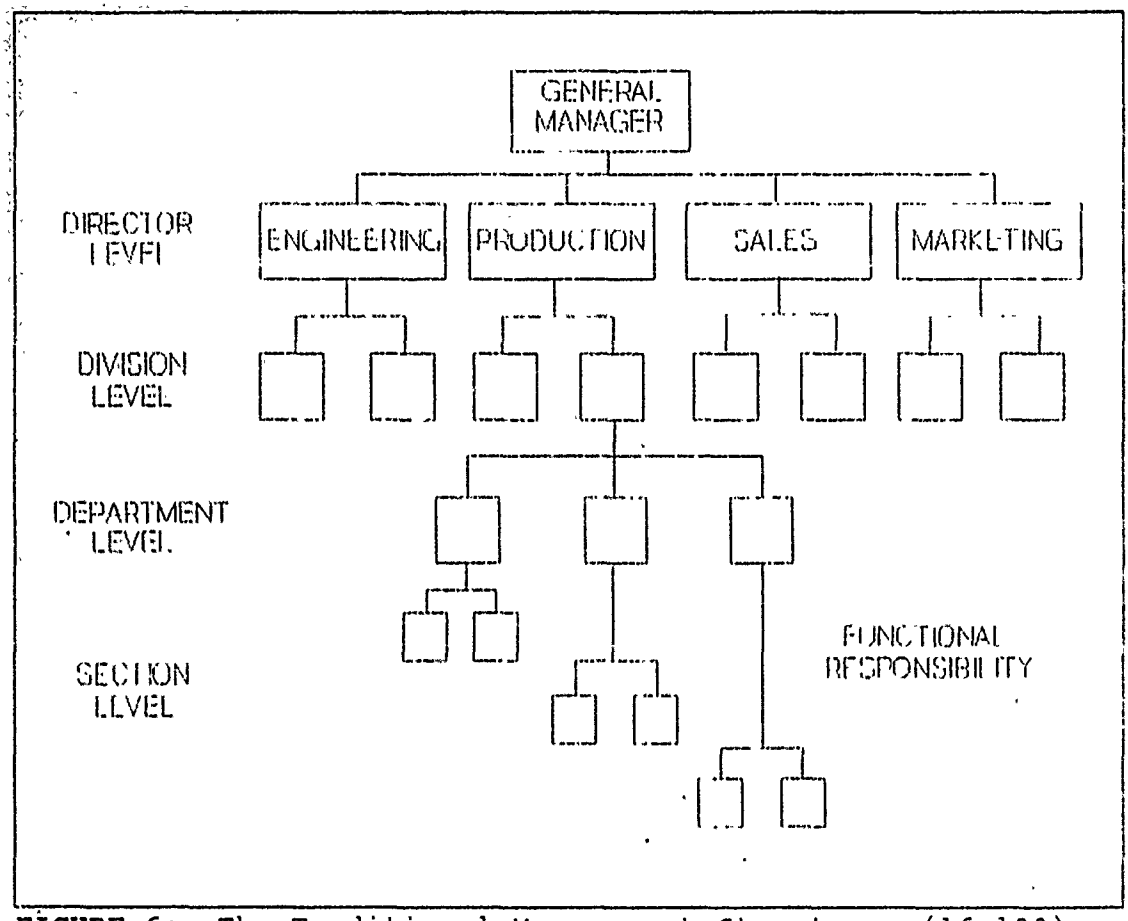

FIGURE 6: The Traditional Management Structure. (16:103)

locations, in the client, in the contract terms and conditions, in the schedule, in the financial approach to the project, and in a broad range of international factors, all of which require a different and flexible approach to managing each project (14:5).

Growth of Project Management. Project management as an accepted organizational paradigm is relatively modern. Project management techniques have been used by chemical and construction companies since the 1940's, and in the military for many years (20:1), but most authors recognize that

modern project management practices began with the Manhattan Project and the development of the atomic bomb during the early 1940's (19:4). The project management philosophy used during this project was recognized for its effectiveness:

> ...with the advent of complex military, civilian and space systems, the project approach has taken on a new significance...it now appears to be the most effective technique available for managing the development of large, complex systems involving many different technologies and often extensive subcontracting. (20:1)

By the early 1960's, literature discussing project management was published and experiments were accomplished by such companies as IBM using early forms of project management. In 1969 the Project Management Institute was established (4:2), and by the 1970's many companies joined with IBM in their use of project managerial disciplines (15:31). During the 1970's and 1980's, companies began to find that project management skills were a necessity in order to survive in the market arena. Companies were beginning "...to expand into multiproduct lines, many of which were often dissimilar, and organizational complexities grew almost without bound" (15:31).

Not all companies needed the benefits offered by project management. However, those with increasing size and complexity, tight resource and performance constraints, much required integration due to the crossing of various functional boundaries, and operations in a dynamic environment were prime candidates for the project management approach (16:28).

Yet even in companies that did need project management, the concepts and techniques behind project management have been slow to gain widespread acceptance until recently. The main reason for this seems to be that project management often requires organizational restructuring and the relinquishment of a certain amount of top managerial power (16:28). Also, even though project management had been around for decades, it was still misunderstood by many people in key positions. It became apparent, however, that the required restructuring was relatively minimal, and that the power lost provided great benefit for the company as a whole. To speed the acceptance of project management, organizations such as PMI were established to increase the general understanding of the purpose and advantages of project management. Thus, by the 1980's, project management had become widely accepted in multifunctional companies.

The Project Management Institute

To promote the benefits offered by project management, the Project Management Institute (PMI) was initiated in 1969. The initial goal of the PMI was to, "...advance the state of the art in the management of projects...and to improve the effectiveness and efficiency of the management of change for the benefit of all mankind" (21:Preface). To accomplish this goal, the PMI would:

- Foster professionalism in the management of projects.

- Identify and promote the fundamentals of project management that are needed in order to advance the body of knowledge for managing projects efficiently and effectively.

- Provide a recognized forum allowing for the free exchange of ideas, applications, and solutions to present day project managerial challenges.

- Stimulate the application of project management to the benefit of both industry and the public.

- Provide an interface between both users and suppliers of the hardware and software required to effectively accomplish project management systems.

- Collaborate with universities and other educational institutions in an attempt to encourage the appropriate educational and career development at all levels in project management.

- Encourage an increased amount of academic and industrial research in the field of project management.

- Foster contacts with other public and private organizations that relate to the field of project management, and cooperate in matters of common interest with project managers. (4:3)

Project Management as a Profession. To accomplish this, the PMI needed to establish the project management field as a unique profession, and initiate a means to establish a "professional" project management workforce. Initially professionalism seems like an abstract concept which can not be measured or recorded. However, after standards are defined, "...professionalism can be measured and therefore delineated within the constraints of the standards as structure. (15:11)" The educational and certification program required to create "professional" managers needed to be tailored to the unique needs of the project management field. In order for this to be done, the

project management field would have to meet five key criteria. These criteria delineate the characteristics required of a comprehensive and quality professionalism program. They are:

1. An identifiable and independent body of knowledge of project management (Standards);

2. Supporting educational programs by an accredited institution (Accreditation);

3. A qualifying process (Certification);

4. A code of ethics, and

5. An institution representing members with a desire to serve. (21:0•1)

Importance of the Body of Knowledge. Early PMI members realized that a body of knowledge would be required before accreditation and certification could be accomplished. Such a body of knowledge would have to be project management specific. Thus, the key to meeting these criteria was the development and ultimate acceptance, by experts in the field of project management, of a standard Project Management Body of Knowledge which contained the general information required of any effective project manager. Such a body of knowledge would form the foundation of the profession (17:11). The body of knowledge would be used for many purposes, "...but most specifically it would provide the common denominator which binds all parts of the professionalism program together" as in Figure 7 (17:12).

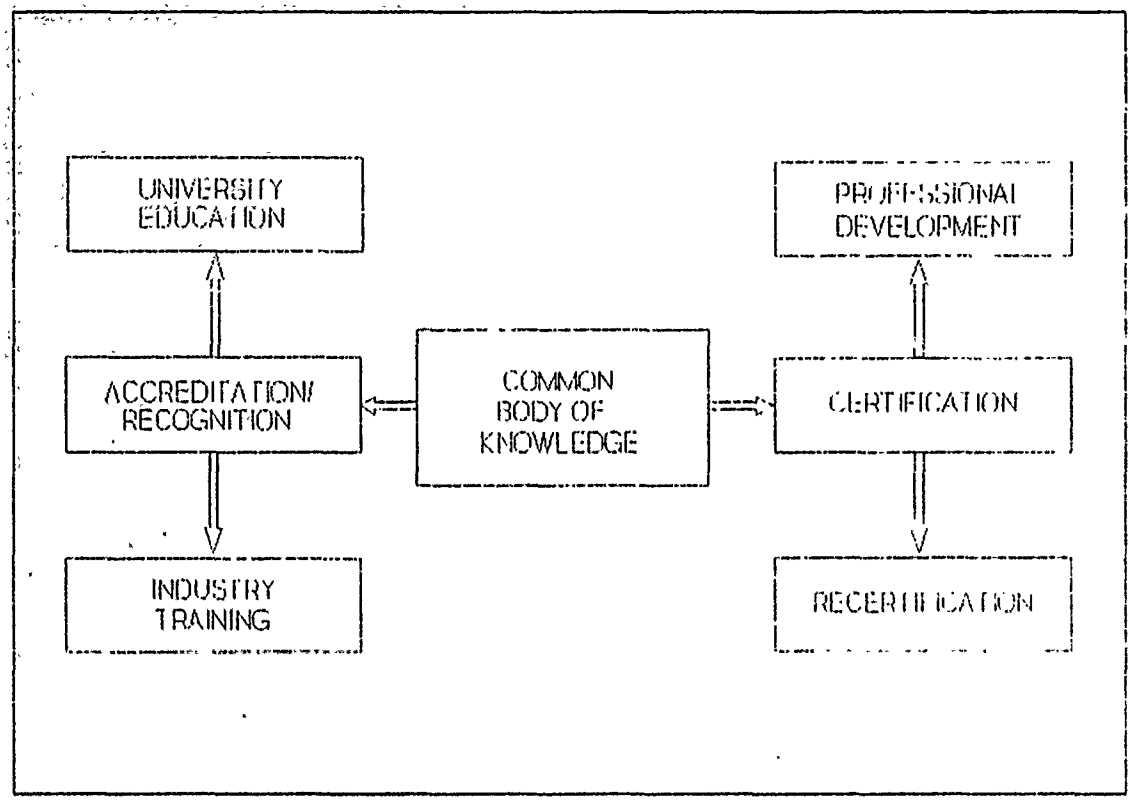

FIGURE 7: The Role of the Body of Knowledge.

Certification of Project Managers. The body of knowledge would first serve as the basis for the development of certification examinations. These examinations would be used as a feedback tool in determining how well the prospective professional project manager had mastered the terms, concepts, ideas, etc considered important to the project management field (17:12). The certification program would in turn form the basis of a recertification program to require that professional project managers remain involved with the profession and current with its growth. Finally, the certification process would provide a goal and model for the professional development of neophyte project managers

who aspire to become certified as professionals, as well as certified project managers who wish to remain with the profession.

Accreditation and Recognition of Education Programs. For accreditation and course recognition, the body of knowledge would serve as a standard for endorsing university curricula and industry training courses based on the information they provide about project management and its related disciplines. (17:12)

In this manner, establishment of a project management body of knowledge would be the first step in creating a means of establishing a professional project management workforce.

Benefits to Society. A project management profession, united across the many industries and technologies that use the concepts documented in the PMBOK, has a tremendous potential for improving the efficiency with which resources are used and hence the quality of life enjoyed by the citizens of our society. This unity can be achieved through effective communications based upon mutual understanding of a documented and accepted body of knowledge that serves as the basis for developing the project management profession. (21:Foreword)

With this in mind, and with the hope of eventually developing a system which could be used worldwide to train and educate potential project managers, a committee was

established and assigned the task of developing what would one day be the project management body of knowledge. The process of developing and obtaining agreement on the content of the body of knowledge was initiated by PMI as a portion of the job assigned to the Ethics, Standards, and Accreditation (ESA) project. (21:2•1)

Development of the PMBOK. Early work and research by the ESA confirmed that there was indeed a definite and unique body of knowledge in the project management field, satisfying the first criterion of a profession. Further deliberations by ESA resulted in a baseline report which was presented to the PMI board in August 1982 (21:2•1). The report was published in the August 1983 edition of the *Project Management Quarterly* and identified six areas of concentration which were necessary for a body of knowledge to represent the field of project management. These initial six areas were:

1. Scope Management
2. Cost Management
3. Time Management
4. Quality Management
5. Human Resource Management
6. Communications Management (22:564)

Each of these areas was then broken down into topics and subtopics by use of a work breakdown structure.

Once provided with this baseline, the PMI established two programs to add structure to the profession of project management: 1) an accreditation program which endorses educational institutions that teach project management, and

2) a certification program through which individual project managers can qualify for the title *Project Management Professional (PMP)* based on their experience, tested knowledge, and service to the profession. The purpose of these two programs is to enhance professionalism in project management and to, "...force project managers to organize and take stock of their knowledge of project management, perhaps for the first time." (13:557)

The ESA baseline report was first compiled into a formal document in 1986, and the first complete PMBOK draft was published in the 1986 edition of the *Project Management Journal* (22:564). Suggestions and contributions on the draft were solicited from PMI members and were, where appropriate, incorporated into the draft PMBOK. The result was the publishing of the approved, and present, PMBOK on 28 March, 1987 (21:2). The 1987 edition of the PMBOK contained three additional topics which were not included in the 1986 draft. These were (continued from the previous page):

7. Risk Management
8. Contract/Procurement Management
9. Project Management Framework (18:551)

These three additions completed the PMBOK that is still in use today.

The 1987 PMBOK became effective for use by all professional PMI activities on 1 September, 1988 (18:551).

The PMBOK took over six years to complete and was considered to be the cornerstone upon which the PMI would be built in the future:

> The effort to identify and establish standards associated with (project management) follows naturally from PMI's primary dedication. It represents a major Institute endeavour and is the PMBOK's primary purpose. Secondary to this purpose, but equally consistent with PMI's dedication, is to provide the basis and support for PMI professionalism programs, which include Accreditation, Education and Certification. (21:1•1)

It was never PMI's intent that the PMBOK should be a static document. It was well understood by the authors of the PMBOK that the field of project management is extremely dynamic, and that any respective body of knowledge would have to be equally dynamic in order to maintain currency. Yet, the PMBOK, by definition, must be sufficiently comprehensive to define the general practices and principles any project manager must know to be effective. Unfortunately, this is not the case with respect to DoD program managers.

Applying the PMBOK to DoD Program Management. The PMBOK does not meet all of the requirements of the DoD in defining necessary skills. There are four major reasons for these knowledge gaps:

> 1. DoD works under unique circumstances not present in other organizations. A major example is pervasive regulation that anyone working in or doing business with the DoD is responsible to understand and follow (12:17).
>
> 2. The PMBOK assumes that certain "general knowledge" is already possessed by the project manager. Because of this assumption, numerous traits of a project

manager are not included in the PMBOK. In the DoD, however, the majority of project managers have a technical, not managerial background. Because of this, general leadership and management disciplines cannot be assumed but must be taught and then tested in a certification program (21:2•3). Conversely, the competent DoD program manager is skilled in other fields that are emphasized in the DoD, such as systems engineering, logistics, and test and evaluation. These activities receive only cursory attention by the PMBOK.

3. The PMBOK assumes a different project life cycle than that assumed by the DoD. The PMBOK assumes that the project life cycle ends with the termination of the activity needed to develop a facility or product. Within the DoD, however, the program manager retains responsibility over the system through its disposal as illustrated in Figure 8. Thus, the DoD project manager must be familiar with cost and logistic considerations that may span a decade or more (21:1•3).

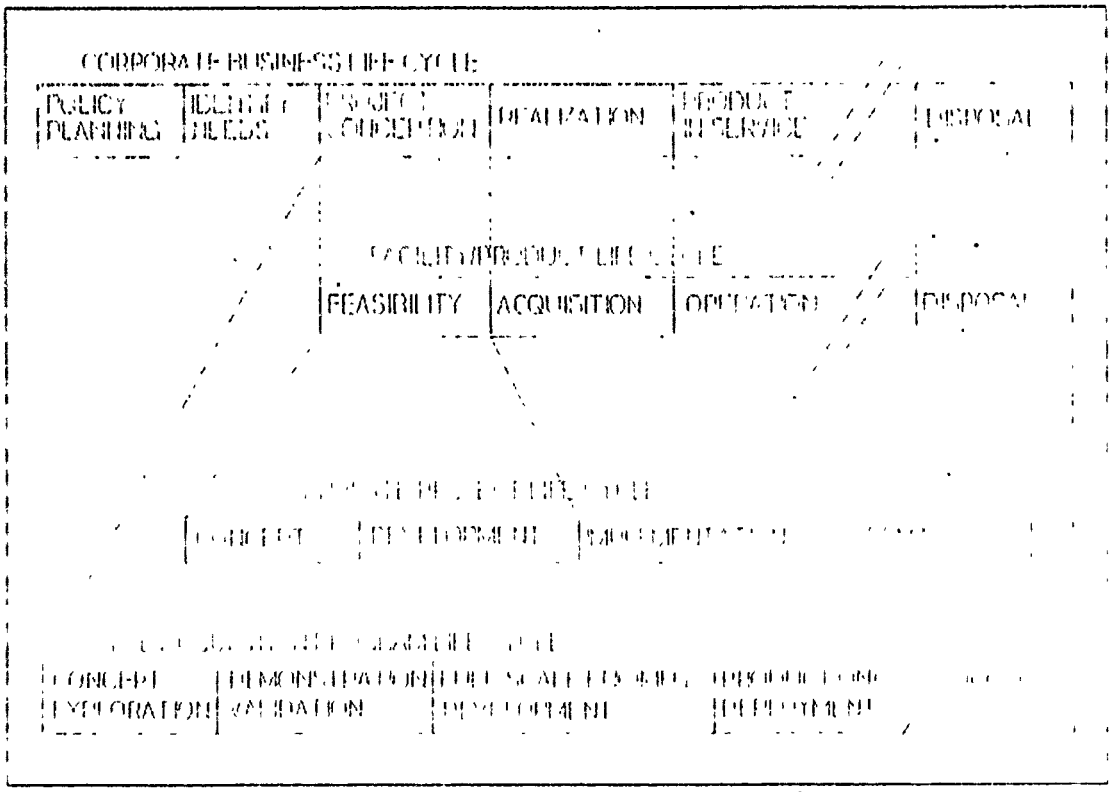

FIGURE 8: Comparison of the Life Cycles of Corporate Projects and DoD Acquisition Programs. (21:1•3)

4. The PMBOK may have missed some key areas which need to be addressed (22:565).

Because of these knowledge/requirement gaps, the categories listed in the PMBOK needed to be modified, and additional categories added, before the needs of the DoD could be met. These changes and additions were determined only after close examination of various expert sources.

DoD Project Management

Prior to World War II the emphasis of defense acquisition was on simplicity, reliability, and producibility. Defense acquisition was comparable to its civilian counterparts, such as the auto industry, which stressed mass-production (12:9-15). Weapon systems such as "...aircraft, ships and tanks, were developed and produced as part of the normal ongoing function of factories, shipyards and arsenals" (2:3). Towards the end of the 1950's emphasis shifted away from long production runs towards increased research, development, evaluation, and testing. After the 1950s the DoD wanted systems that incorporated the most advanced technological innovations. Military budgets were high and resources were available. (12:9-15)

The 1980's and 1990's found a different scenario. The increasing and constantly changing weapon technologies had outpaced the budgets necessary to sustain their development. Since the 1950's DoD acquisitions have switched from mass-

production items to complex, unique weapon systems. This trend is especially visible in the complexity of modern missiles, aircraft, and ships. Such weapon systems, "...include not only the major item of equipment itself, but the subsystems, logistical support, software, construction and training needed to operate and support it" (12:9). By 1986, there were almost 100 major weapon systems at various stages of completion. These systems included, "...thousands of jet fighters, bombers and transport aircraft; one hundred new combat and support vessels; and thousands of tanks and cannon-carrying troop transports and strategic and tactical missiles" (12:9). Such systems were designed to achieve goals and performance levels never before realized and to use technology new to military acquisition. To accomplish this, DoD employs thousands of prime contractors and hundreds of thousands of subcontractors and suppliers (12:9-15). Thus, the switch to project management in DoD acquisitions came about for a variety of reasons including:

- The existence of stringent time, cost and performance requirements
- DoD undertakings are of greater complexity and scope than normally found in the business environment
- Significant contributions were required by two or more functional areas
- The rewards for success, or penalties for failure, were especially high. (2:4)

Another important factor which needs to be considered was the risk encountered by the DoD in major weapon system

acquisition. As technology increases, the risk to both buyer and seller alike increases and thus the management and technological development of a project becomes much more complex. A major weapon system involves the expenditure of large sums of public funds and often projects span numerous years during which literally thousands of components must be delivered and integrated into a workable unit. Due to the dependence on the public for funding, and the time span involved for the project to reach completion, the project manager is faced with a situation which can (and often does) change at any moment, drastically effecting the resources available for project completion (2:26-28). The external environment, as well as the contractors associated with the project, must be constantly monitored and guided by the DoD project manager throughout the lifecycle of the project in order to effectively meet, and respond to, this change and ensure that a quality product is developed and delivered. (12:9-15) Project management offers the flexibility to successfully deal with these changes in a time efficient manner.

Training and Educating DoD Managers. Although most neophyte DoD project managers are trained with respect to the technology of their project, they tend to lack a basic understanding of the managerial functions which are required in order to perform their jobs effectively. Because of this "knowledge gap" the full benefits offered by using project

management as a means of system acquisition are not being realized and the problems noticed in past defense acquisitions are being repeated in the present. (2:60)

In an attempt to correct these problems, the DoD has two primary institutions for defining and teaching project management. These institutions are the Defense Systems Management College (DSMC) near Washington D.C., and the Air Force Institute of Technology, near Dayton, Ohio.

The Defense Systems Management College. The Defense Systems Management College (DSMC) was established in 1971 under the direction of Deputy Secretary of Defense David Packard (5:5). The purpose of the DSMC is to:

> ...create an atmosphere of quality which fosters personal growth, professional development and empowerment of its people and its customers; by the 21st century it will be the Department of Defense focus of excellence in acquisition education, research, and information dissemination. It will enhance public confidence by leading continuous improvements in the acquisition management process throughout congress, the Department of Defense, and the defense industry. Through high quality of service to the entire range of customers, DSMC graduates will be recognized by lawmakers, policy makers and decision makers as the preeminent academy of acquisition management. (5:7)

Every prospective DoD Program Director is required to attend a 20-week Program Management Course at DSMC before taking command of a major program. A Major Defense Acquisition (Category I) Program in the DoD exceeds $300 Million in research and development cost or $1.3 Billion in total procurement cost (fiscal year 1990 dollars). (9:3)

There are nine basic areas of study that are covered during the student's 20 week stay at DSMC. These include:

1. Acquisition Management
2. Financial Management
3. Procurement Planning and Contract Management
4. Engineering Management
5. Logistics Management
6. Test and Evaluation
7. Production Management
8. International Activities, Joint Programs and Foreign Material Sales
9. Other (6:v-vii)

The Air Force Institute of Technology. The Air Force institute of Technology was established in 1947 and offers numerous short courses in the field of acquisition program management such as Acquisition Planning and Analysis, Test and Evaluation Management, Contract Management, and Logistics Management. It also has an accredited Master of Science degree program in Systems/ Project Management that is offered on a competitive basis to military officers and DoD civilian employees.

The goal of both these DoD institutions is to ensure that, "...members of our military services and associated civil servants in the defense acquisition business have the necessary expertise to manage defense systems effectively" (5:7).

Continuing Problems in DoD Acquisition. Even with the education offered by DSMC and AFIT, problems continue to be noted in the defense project management workforce. Such problems include purchase of unreasonably high priced items and program cost overruns. Schedules have been extended by

about 38% in approximately half of DoD acquisition programs. Also, more than nine in ten programs have exceeded initial cost estimates and the average cost increase for the majority has been more than 50%, excluding the effects of quantity changes and inflation. (12:33)

Such problems, "...caused many Americans to question DoD's management capability as well as the integrity of the defense industry" (12:31). In order to reverse such trends and alleviate public doubt, project managers must become more effective and efficient in the performance of their jobs.

Conclusion

The public attention that is focused on DoD project managers, together with the responsibility and control those managers have over appropriated public funds, are enough to underscore the importance of a highly trained and competent corps of project managers at all levels of DoD acquisition management activities. The education and training of DoD project managers must become standardized, comprehensive, and verifiable. This can be accomplished by establishing a defense-specific project management body of knowledge which can be further used to develop education and training programs, and to certify potential DoD program managers that have mastered the body of knowledge.

III. Methodology

Introduction

This section discusses the development of a model DoD Project Management Body of Knowledge, and describes the process by which this model was finalized and validated.

Methods of Approach

Two research methods were used to accomplish this thesis: History and Survey. The history method involved a comprehensive literature review which gathered information from four areas:

1. The Project Management Institute's Project Management Body of Knowledge (PMBOK)
2. DoD project management institutions
3. Project management literature
4. DoD subject matter experts

The section "Development of a Hypothetical Model" describes how these sources were used to develop a draft version of the DBOK.

The survey method involved a mail survey distributed to every program director and deputy program director of a Major Defense Acquisition (Category I) program. The results of this survey were used to validate the draft DBOK. The section "Validation of the Hypothetical Model" discusses the survey, the survey instrument, and the treatment of the resulting data.

Development of the Hypothetical Model. The hypothetical model of the DBOK was built in a top-down manner, beginning with the structure of the model, followed by selection of major subject areas, and concluding with selection of subareas within each major subject area. Each phase of the development process of the hypothetical model is discussed below.

Structure. The structure of the hypothetical model was patterned after the PMI's PMBOK. The PMBOK is organized as a list of eight major subject areas, all of which are further broken down into subareas by using a work breakdown structure. The DBOK was initiated in the same manner. Major areas, the foci of the DBOK, were determined and then were further broken down into subareas.

Content: Major Subject Areas. The major areas of the model DBOK were derived from three sources. The first source was the PMBOK. Experts from PMI did much preliminary work on the development of the PMBOK during the early 1980's. In order to avoid duplication the PMBOK was used as the starting point for the content of the DBOK. The major subject areas of the PMBOK are:

- Scope Management
- Quality Management
- Time Management
- Cost Management
- Risk Management
- Human Resources Management
- Contract/Procurement Management
- Communications Management

(21:3•5)

The Second source was DoD project management educational institutions. The two institutions examined were DSMC and AFIT. It was essential to research these institutions because their curricula represent the best present model of the specific skills and knowledge required to be a competent project manager in the DoD environment. Both curricula were examined and it was seen that, as expected, they heavily overlapped one another. Since the DSMC Program Management Course (PMC) curriculum had already been compiled into an easily readable and usable format, DSMC became the primary educational source while the DBOK was being developed. AFIT course documents were used as a secondary source.

The third source was the literature in the project management field that was discussed throughout Chapter II of this document. This literature was reviewed to identify the subject areas that experts in the field of project management considered to be important. It was necessary to cover a significant amount of literature due to the possibility that both PMI and DoD project management institutions may have missed important topics. The bibliography lists the texts and materials consulted.

After examination of the three sources, a total of 13 major subject areas were identified and input to the model DBOK structure. Figure 9 shows how the major subject areas in the PMBOK and the DSMC PMC curriculum correlate to those in the model DBOK.

Content: Subareas. After the 13 major subject areas were determined, subareas were added to each area using the same source references discussed in the previous section. Initially many candidate subareas were identified under each major area. These subareas were carefully edited and combined to make each area as parsimonious as possible while remaining exhaustive of knowledge requirements. The product of this process was the first complete draft of the DBOK.

The draft DBOK was presented to experts for comments. The experts used were the AFIT faculty and The Department of Educational Research at DSMC. Each instructor at AFIT and DSMC specializes in a specific aspect of project management and has a basis for understanding the unique knowledge requirements of DoD project managers. The major subject areas were extracted individually with their associated subareas and were distributed to the respective subject experts for comment. In all cases, additions and deletions

PMBOK:		DSMC PMC:		DBOK:
SCOPE		MANAGERIAL		STRATEGY & PLANNING
TIME		DEVELOPMENT		MANAGEMENT TECHNIQUES
COMMUNICATION &INFORMATION				LEADERSHIP
HUMAN RESOURCES		PRINCIPLES OF		& PERSONAL SKILLS
QUALITY		PROGRAM		QUALITY MANAGEMENT
RISK		MANAGEMENT		RISK MANAGEMENT
COST		COST/SCHEDULE CONTROL		COST
		CONTRACTOR FINANCE		MANAGEMENT
		FUNDS MANAGEMENT		
PROCUREMENT		CONTRACT MANAGEMENT		CONTRACT MANAGEMENT
		SYSTEMS ENGINEERING		SYSTEMS ENGINEERING
		TEST & EVALUATION MANAGEMENT		TEST & EVALUATION MANAGEMENT
		LOGISTICS		LOGISTICS
		MANUFACTURING MANAGEMENT		MANUFACTURING MANAGEMENT
		SOFTWARE		SOFTWARE MANAGEMENT
		INTERNATIONAL PROGRAM MANAGEMENT		AEROSPACE
		DEFENSE ACQUISITION POLICY & ENVIRONMENT		& DEFENSE MANAGEMENT

FIGURE 9: Development of DBOK Major Areas from the PMBOK and the DSMC PMC Curriculum.

were made to the model DBOK to reflect the inputs made by the instructors. The result was a revised model DBOK, consisting of the 13 major subject areas and associated subtopic areas ranging in number from 7 to 13.

Validation of the Hypothetical Model

The hypothetical model DBOK was validated with a survey administered by PMI to all directors and deputy directors of Major Defense Acquisition (Category I) programs.

Survey. The purpose of the survey was to solicit feedback from practicing experts in the field of DoD acquisition program management. The population of program directors and deputy directors of major DoD acquisition programs is a population of experts, and as such, is the best community to review and validate the hypothetical model DBOK.

Survey Background. The survey was used to measure the importance of each major subject area and each subarea in the model DBOK. The survey was necessary to either validate the model DBOK as being complete (e.g., collectively exhaustive of the knowledge necessary to be a competent Defense Project Manager) or to complete the DBOK. Two governing assumptions were applied at the beginning of the survey process.

1. The model was basically sound, and no "bad" areas or subareas would withstand scrutiny of the AFIT faculty and DSMC. Therefore few, if any, major areas or subareas would need to be deleted as a result of the survey.

2. Any weakness of the hypothetical model would be that important subject areas or associated subareas had been omitted.

With respect to these assumptions the survey was designed to solicit feedback from each respondent as to what should be added to the body of knowledge. Conversely, the opportunity for deletion was also present in the form of a "Comment" section in the survey instrument.

Survey Instrument Design. Much of the survey design was based on Dillman's Mail and Telephone Surveys: the Total Design Method.

The DBOK questionnaire contained five sections:

1. A ranking of the 13 major subject areas

2. A rough prioritization of the subareas associated with each major area

3. An identification of additional training requirements

4. Demographic information

5. Glossary.

The survey instrument with the model DBOK can be seen at Appendix B.

Part I: Area Ranking. The objective of the first section of the survey was to prioritize the major areas. The questionnaire listed only the major subject area titles in the model DBOK. Each was briefly defined. The

respondent was asked to rank the areas, 1 through 13, in terms of their relative importance to the working-level project manager. Two additional choices labeled "OTHER" were opportunities for the respondent to identify additional major subject areas which should be added to the DBOK.

Part II: Subarea Prioritization. The objective of the second section was to prioritize the subareas within each area. The entire model DBOK, major subject areas and associated subareas, was displayed. The respondent was asked to mark a "T" ("top importance") next to the three most important subareas under each major subject, and a "B" ("bottom importance") next to the three least important subareas. This method minimized the time required to complete the section, thus averting respondent frustration and the negative effects such frustration would have had on the response rate. Restricting all respondents to six entries per area (three T and three B) normalized the input per respondent per area, and controlled the central tendency of all subarea scores to 1.0. This was significant because it prevented respondents from corrupting the response data by marking all subareas as of top or bottom importance in a favored or least-favorite area. As in the first section, blank spaces were included for the respondent to enter additional subareas that were required.

Part III: Training Needs. The third section of the survey assessed training needs. the respondent was

again presented with the entire model DBOK and was asked to circle any subarea(s) where there was an acute training need. Also, the respondent was asked to specify the most effective method to impart such training (e.g., on-the-job training, short courses, etc).

Part IV: Demographics. The fourth section was a series of demographic questions regarding the respondent's service affiliation, position, experience, education, and job satisfaction.

Part V: Glossary. The fifth and last section consisted of a glossary which briefly defined each subarea mentioned in the model DBOK. The glossary served two purposes; 1) to prevent any biases in the response data due to differences between service vocabularies, and 2) to minimize noise in the data due to individual interpretations of subarea titles.

Survey Pre-Test. The draft survey was pre-tested on a sample of 25 AFIT graduate students in the Systems/ Project Management degree program. Most of these students have had prior experience in the acquisition arena as DoD project managers. The comments about the survey design were superficial and varied. No two comments addressed the same issue. The conclusion from the pre-test was that the survey was understandable and structurally sound. No changes to the questionnaire resulted from the pre-test. (11:206-207)

Survey Distribution. The survey was distributed by PMI to all directors and deputy directors of Major Defense Acquisition (Category I) programs. Approximately three weeks were allowed for response. The Department of Educational Research at DSMC, co-sponsor of the survey with PMI, received the completed questionnaires. At the three week point the surveys that had been returned were analyzed.

Analysis

This section discusses the reduction of the body of survey response data and the decision rules governing the survey results. The response data were input manually into a 337 x N array, where N represents the number of responses. The data were reduced using Quattro Pro (v.2.0) spreadsheet software. Quattro Pro was also used to develop the graphic displays shown later in this document. The methodologies governing data reduction are described below.

Part 1: Major Area Ranking. The set of responses for each major area in Part 1 was simply averaged to determine the final prioritization of major areas. The average "score" for each major area represents its relative importance on a 1 to 13 scale (1 most important). Major areas that were added by respondents were treated according to the following rule:

> *Decision Rule - Treatment of Major Areas Added by Respondents:* If a major area was added and ranked by respondents such that its score was greater than the score achieved by the lowest of the original thirteen, then it was added to the BOK; else, no major area was added.

Part 2: Subarea Ranking. The survey responses for each subarea in Part 2 were treated as follows: score of 0 for each subarea awarded a "B," score of 1 for each subarea awarded neither "B" nor "T," and score of 2 for each subarea awarded a "T." The mean score was calculated for each subarea. The mean score represents the importance of that subarea, relative to the others in the area, on a 0 to 2 point scale (2 most important). Subareas that were added by respondents were treated according to the following rule:

> **Decision Rule - Treatment of Subareas Added by Respondents:** If a subarea was added and ranked by respondents such that its final score was greater than that achieved by the lowest scoring subarea in the major area, then it was added to the BOK; else, no subarea was added.

Part 3: Training Needs. The training needs of DoD project managers were assessed as follows. For each response, a score of zero was assigned each subarea not indicated as a training need area. A positive score was assigned each subarea identified as a training need area; that score was equal to the number selected as the ideal type of training (e.g., score of 3 if Short Course was identified). The Frequency function in Quattro Pro was used to determine the distribution of entries for each subarea. The result was, for each subarea, the number of respondents that identified that subarea as a training need, and the best training method indicated.

IV. Findings

Introduction

This section presents the results of the survey and the final, validated Defense body of knowledge.

Survey Results: Response and General Feedback

Out of 148 questionnaire packages mailed, 53 were returned for a total response rate of 36%. All questionnaires that were returned contain useable data on which the remainder of this chapter is based.

General feedback added by respondents to the comment page at the end of the survey is summarized at Appendix C.

Survey Results: Body of Knowledge

Part I: Major Areas. The reduced data from the major area ranking are listed in Table 1. Two columns show the mean rank ($\bar{X}$) and standard deviation (σ) for each major area listed in the left column. In Table 1 the lower rank represents the higher priority. The results are displayed graphically in Figure 10. The horizontal bar chart displays the relative importance of each major area with the most important (lowest score, short bars) to the left of the chart. To the right of each bar is the mean numeric ranking of that area.

TABLE 1:

MAJOR AREA PRIORITY
(LOW Xbar = HIGH PRIORITY)

MAJOR AREA:	Priority ($\bar{X}$)	Standard Deviation (σ)
STRATEGY AND PLANNING	3.74	2.71
QUALITY MANAGEMENT	7.72	3.34
COST MANAGEMENT	5.00	2.65
RISK MANAGEMENT	5.53	3.02
LEADERSHIP/PERSONAL SKILLS	2.89	2.94
MANAGEMENT TECHNIQUES	5.89	3.29
SYSTEMS ENGINEERING	6.81	2.79
TEST AND EVALUATION MANAGEMENT	9.08	2.31
LOGISTICS MANAGEMENT	9.36	2.13
MANUFACTURING MANAGEMENT	10.85	2.42
CONTRACT MANAGEMENT	6.92	2.57
SOFTWARE MANAGEMENT	10.13	2.87
AEROSPACE AND DEFENSE MANAGEMENT	5.62	3.96

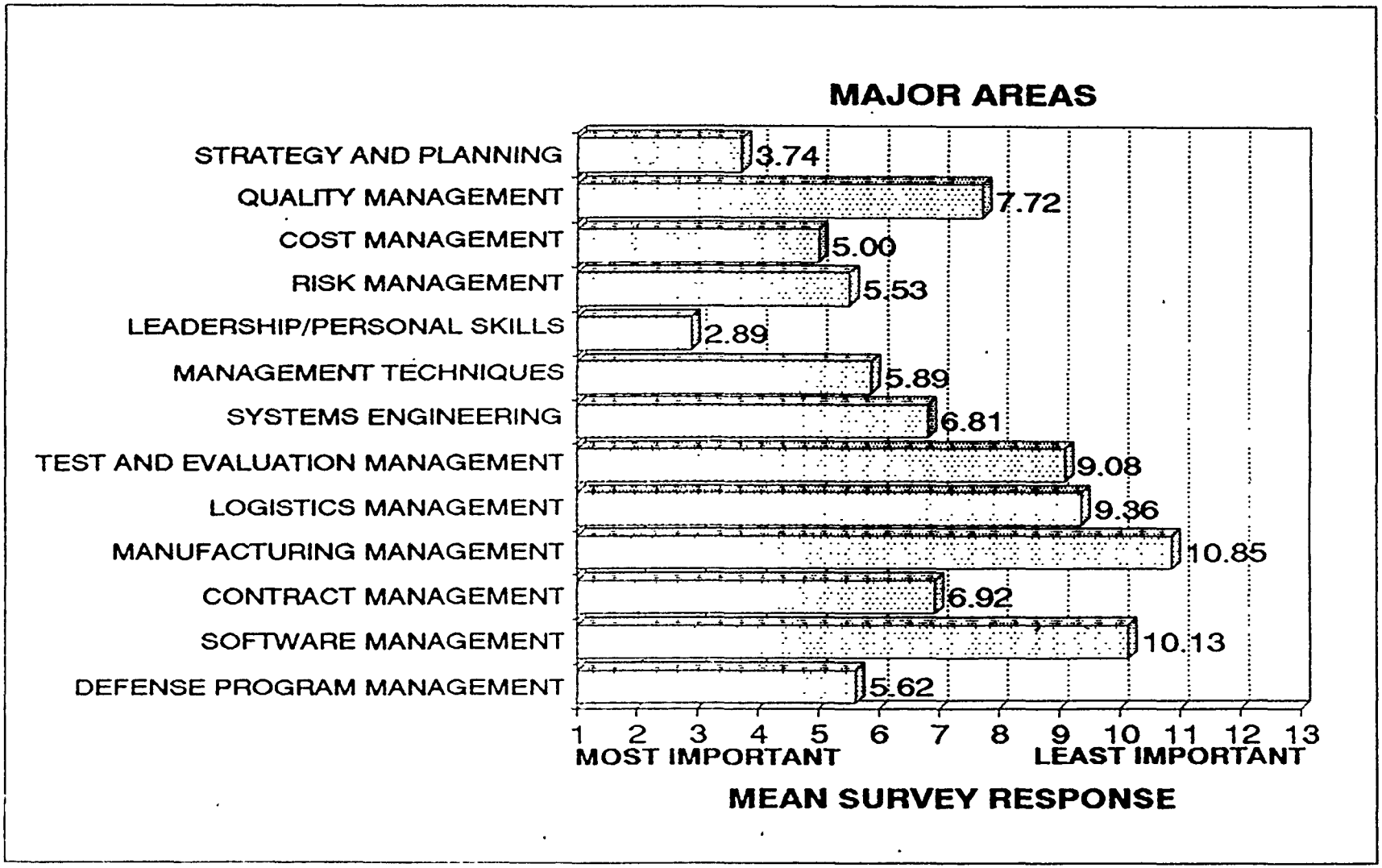

FIGURE 10: Survey Results: Major Area Ranking. (N=53)

Part II: Subareas. The ranking of the subareas within each major area are presented below.

Strategy & Planning. Table 2 displays the results of the Strategy & Planning subarea ranking in terms of mean importance and standard deviation. Unlike the data in Table 1 above, Table 2 and those that follow show the more important subareas with higher scores. Figure 11 shows the results graphically. As is the case with the tabular data, the scale on the horizontal axis in Figure 11 is reversed from that of the Major Area display; the left of the chart represents the lowest priority, the right of the chart (highest score, long bars) represents the highest priority.

TABLE 2:

RESULTS OF STRATEGY & PLANNING PRIORITIZATION
(HIGH Xbar = HIGH IMPORTANCE)

Subarea:	Importance ($\bar{X}$)	Standard Deviation (σ)
Work Breakdown Structure	0.75	0.85
Statement of work	1.19	0.79
Network Analysis	0.40	0.57
Project Life-Cycle Analysis	0.92	0.81
Forecasting	0.74	0.86
Management Information Systems	0.83	0.78
Acquisition Strategy/Planning	1.83	0.47
Acquisition Process	1.47	0.80

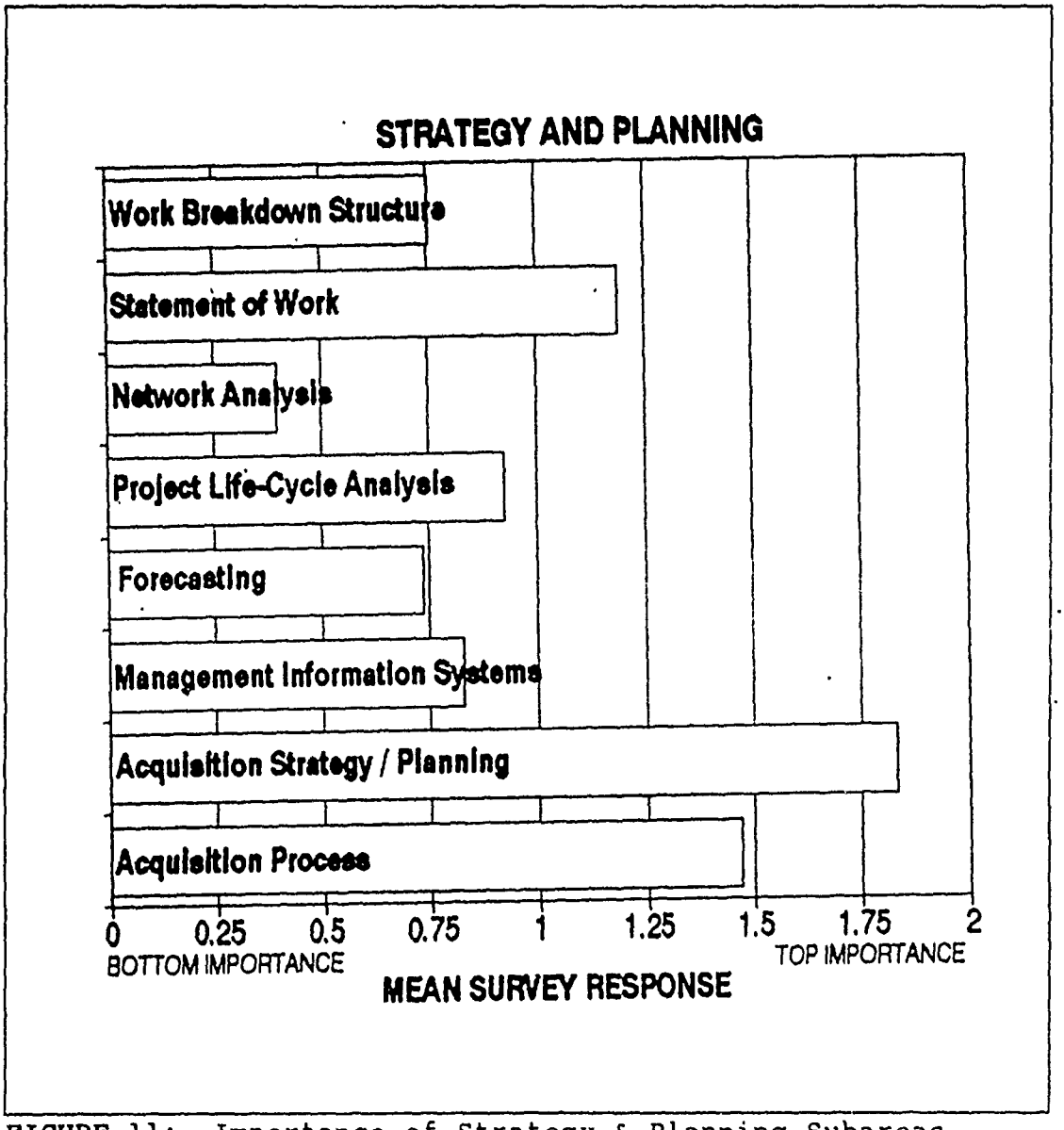

FIGURE 11: Importance of Strategy & Planning Subareas. (N=53)

Quality Management. Table 3 shows the results of the prioritization of the subareas within the Quality Management area. Figure 12 displays the data graphically.

TABLE 3:

RESULTS OF **QUALITY MANAGEMENT** PRIORITIZATION
(HIGH Xbar = HIGH IMPORTANCE)

Subarea:	Importance ($\bar{X}$)	Standard Deviation (σ)
Quality Assurance	1.04	0.90
Total Quality Management	1.74	0.62
Quality Controls/Standards	0.81	0.79
Quality Costs	0.55	0.72
Quality Theory	0.38	0.71
Quality Evaluation Methods	0.96	0.88
User/Customer Relations	1.62	0.69

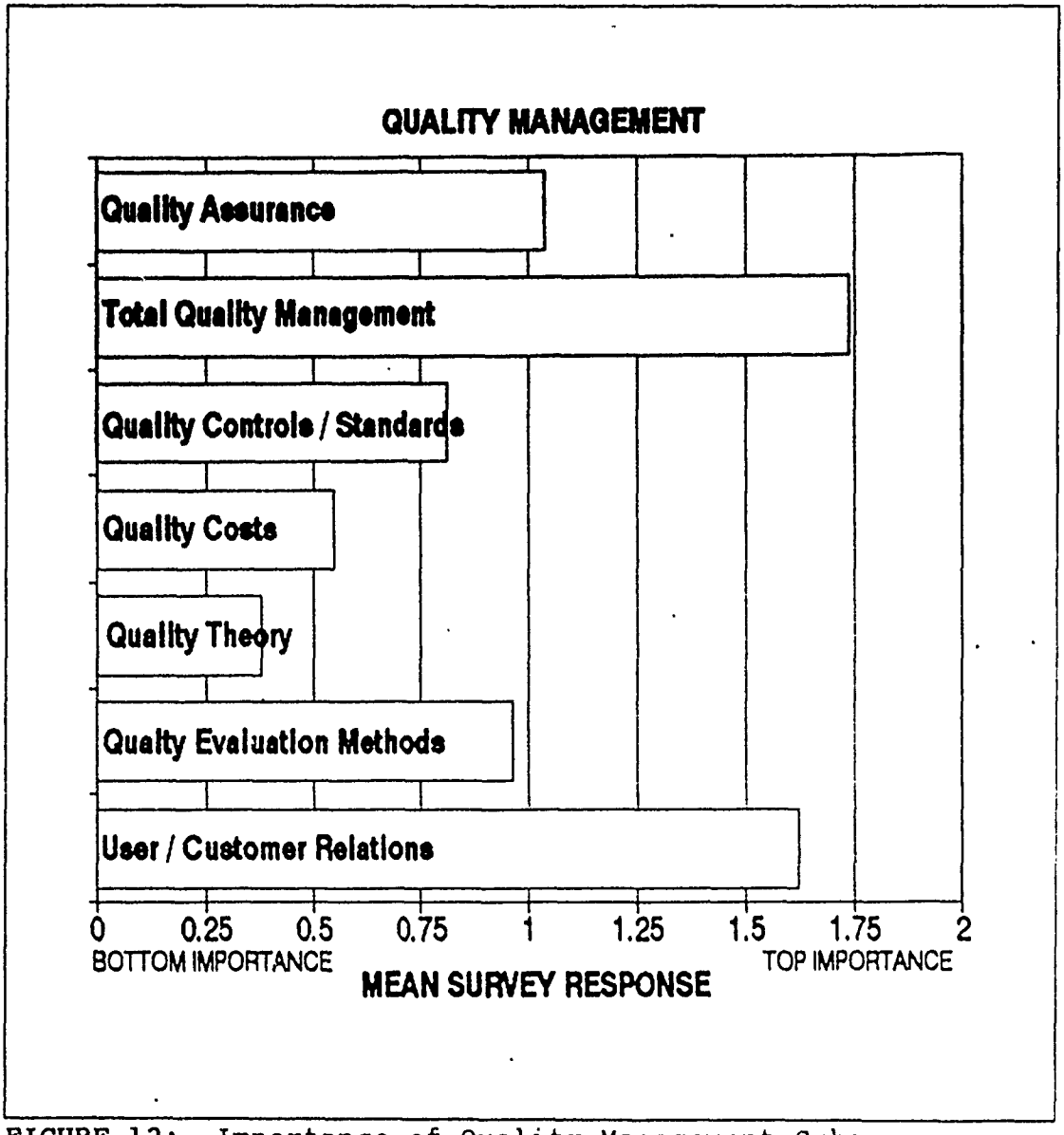

FIGURE 12: Importance of Quality Management Subareas. (N=53)

Cost Management. Table 4 illustrates the prioritization of the subareas within the Cost Management area. Figure 13 displays the data graphically.

TABLE 4:

RESULTS OF COST MANAGEMENT PRIORITIZATION
(HIGH Xbar = HIGH IMPORTANCE)

Subarea:	Importance ($\bar{X}$)	Standard Deviation (σ)
Estimating	1.23	0.70
Life Cycle Cost Analysis	1.19	0.65
Design to Cost	0.66	0.71
Planning, Programming & Budgeting System	1.68	0.61
Reprogramming	0.91	0.66
Cost/Schedule Control	1.64	0.52
Contractor Financial Management	1.26	0.62
Financial Analysis of DoD Contractors	0.62	0.60
Project Accounting	0.70	0.64
Capital Investment	0.36	0.48
Should Cost/Could Cost Analysis	0.81	0.59

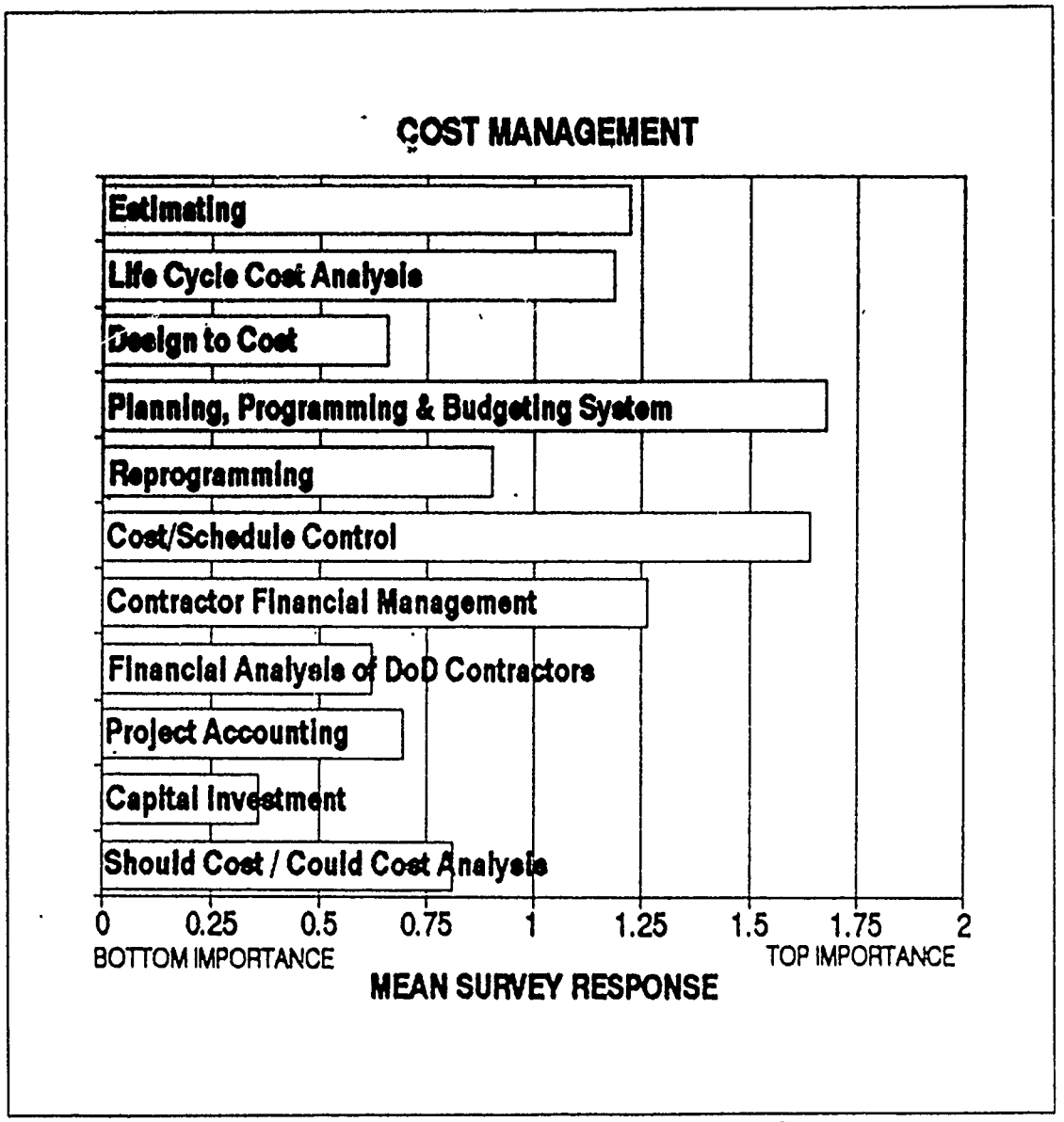

FIGURE 13: Importance of Cost Management Subareas. (N=53)

Risk Management. Table 5 provides the results of the prioritization of Risk Management subareas. Figure 14 shows the results graphically.

TABLE 5:

RESULTS OF RISK MANAGEMENT PRIORITIZATION
(HIGH Xbar = HIGH IMPORTANCE)

Subarea:	Importance ($\bar{X}$)	Standard Deviation (σ)
Risk Planning	1.26	0.86
Risk Assessment	1.70	0.50
Sources of Risk	0.85	0.79
Risk Identification	1.75	0.52
Risk Analysis	1.17	0.67
Risk Avoidance	0.75	0.76
Unavoidable Risk	0.13	0.39
Value Analysis	0.47	0.72

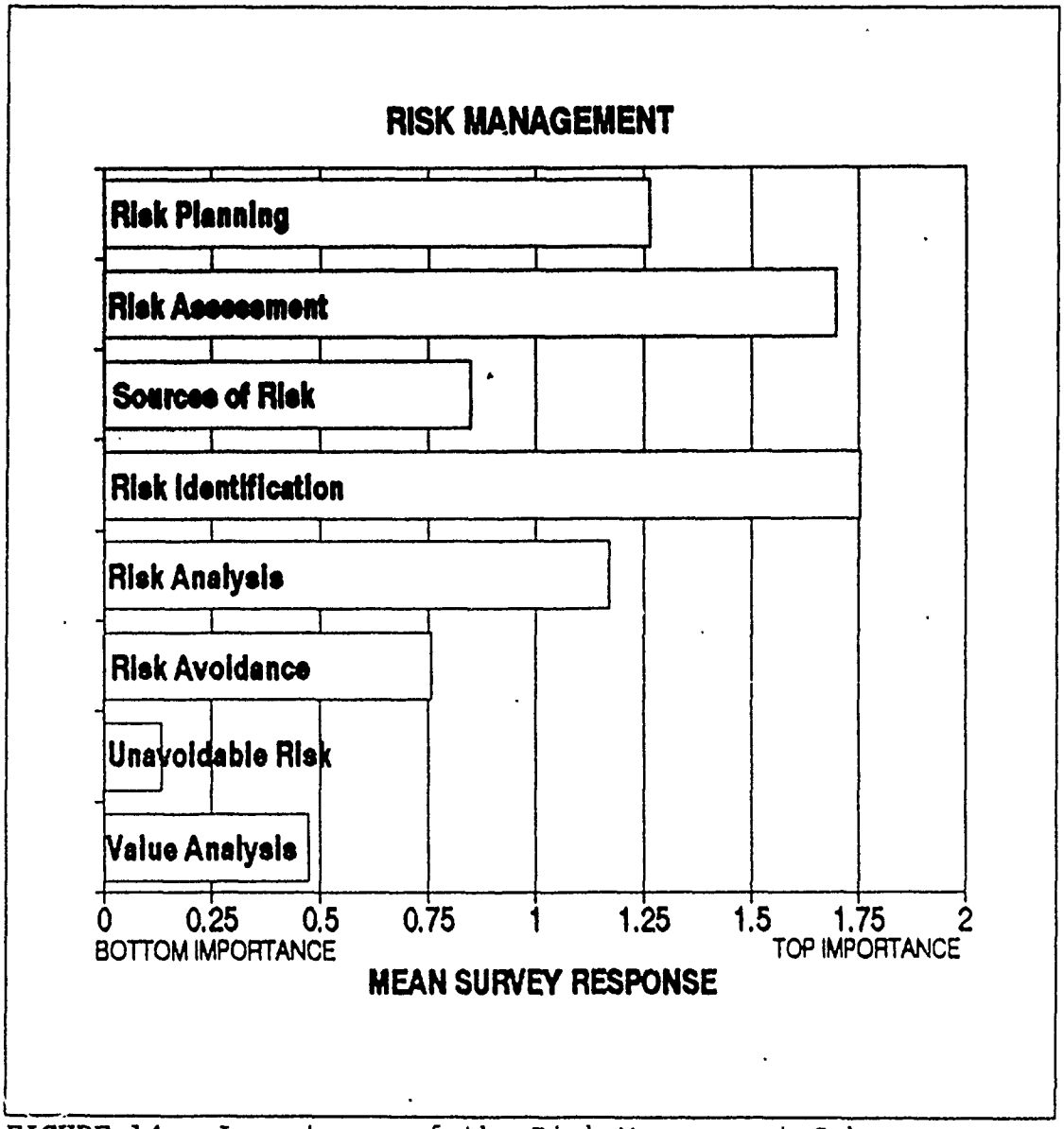

FIGURE 14: Importance of the Risk Management Subareas. (N=53)

Leadership/Personal Skills. The results of the Leadership/Personal Skills subarea prioritization are listed in Table 6. The prioritized subareas are displayed in Figure 15.

TABLE 6:

RESULTS OF **LEADERSHIP/PERSONAL SKILLS** PRIORITIZATION
(HIGH Xbar = HIGH IMPORTANCE)

Subarea:	Importance ($\bar{X}$)	Standard Deviation (σ)
Personal Ownership & Commitment	1.45	0.72
Motivation & Influence	1.32	0.67
Political/Organizational Awareness/Power	0.92	0.85
Relationship Development & Team Building	1.60	0.69
Action Orientation	0.51	0.67
Long-Term Perspective	0.77	0.72
Ethics	1.51	0.64
Assertiveness	0.26	0.56

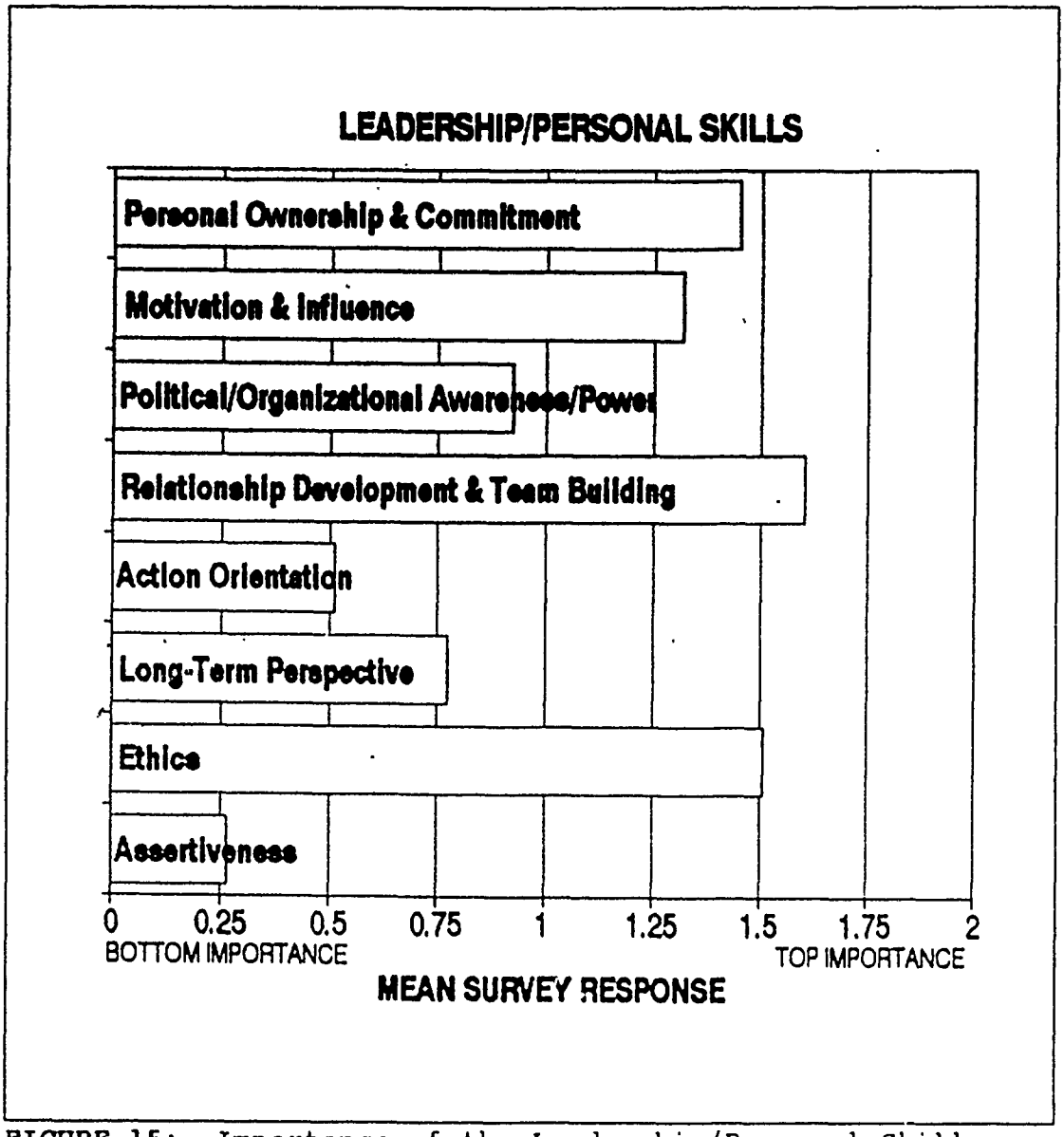

FIGURE 15: Importance of the Leadership/Personal Skills Subareas. (N=53)

Management Techniques. The Management Techniques prioritization results are listed in Table 7. The data are presented graphically in Figure 16.

TABLE 7:

RESULTS OF **MANAGEMENT TECHNIQUES** PRIORITIZATION
(HIGH Xbar = HIGH IMPORTANCE)

Subarea:	Importance ($\bar{X}$)	Standard Deviation (σ)
Organization & Staffing	1.08	0.78
Training, Developing	1.06	0.79
Counseling & Evaluating	0.87	0.62
Communicating	1.77	0.42
Time Management	1.04	0.71
Negotiating	0.68	0.73
Decision Making	1.64	0.52
Controlling	0.40	0.66
Managing Meetings	0.51	0.72

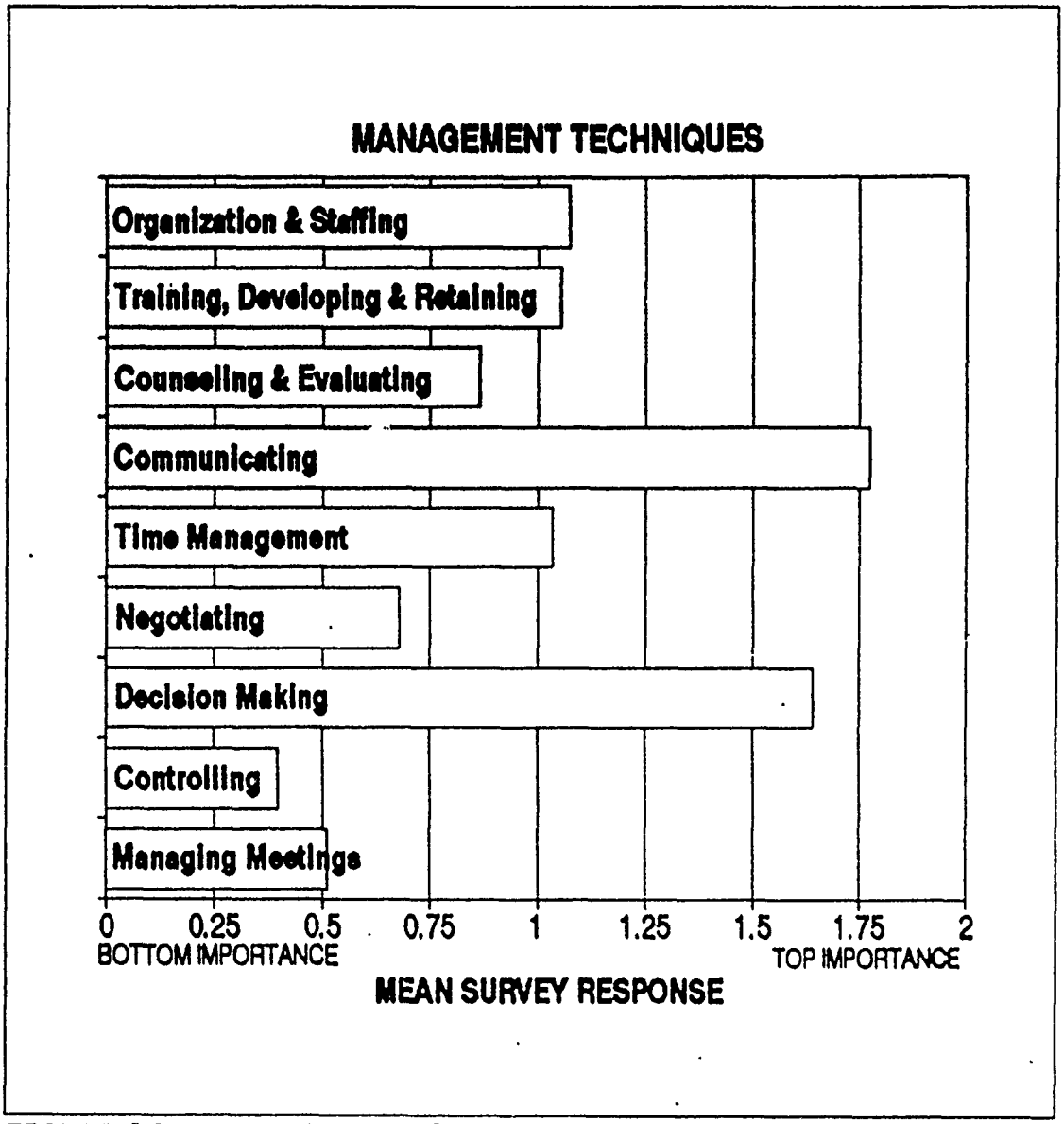

FIGURE 16: Importance of Management Techniques Subareas. (N=53)

Systems Engineering. The results of the prioritization of Systems Engineering subareas are listed in Table 8. The data are presented graphically in Figure 17.

TABLE 8:

RESULTS OF SYSTEMS ENGINEERING PRIORITIZATION
(HIGH Xbar = HIGH IMPORTANCE)

Subarea:	Importance ($\bar{X}$)	Standard Deviation (σ)
Trade-Off Analysis	1.51	0.72
Technical Performance Measurement	1.43	0.72
Technical Review Process	1.00	0.90
Producibility Engineering & Planning	0.66	0.65
Engineering Change Procedures	0.94	0.74
Pre-Planned Product Improvement	0.74	0.76
Configuration Management	1.26	0.52
Specifications & Standards	0.70	0.72
Integrated Product Development	1.04	0.88

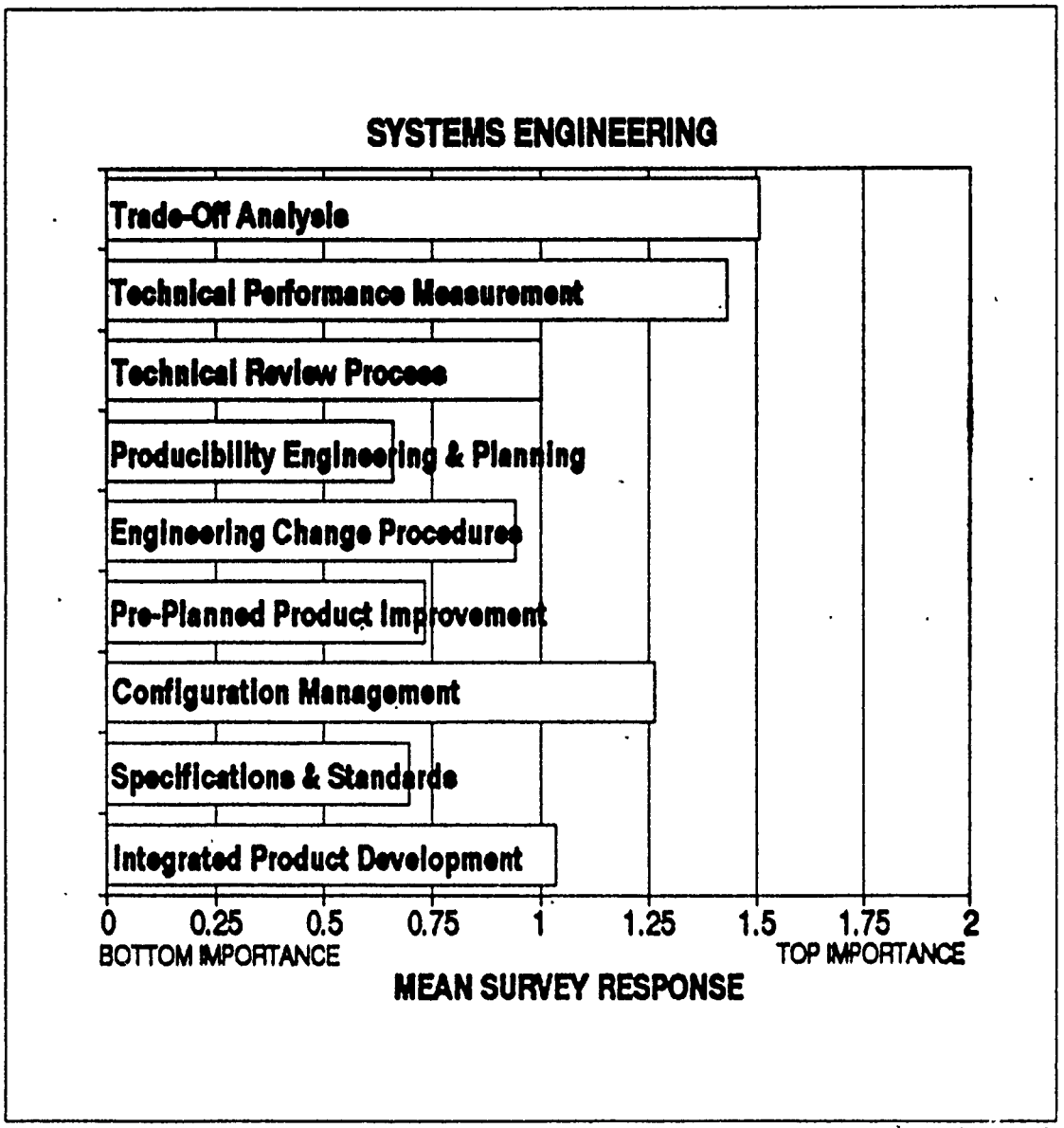

FIGURE 17: Importance of Systems Engineering Subareas. (N=53)

Test and Evaluation Management. The subareas within Test and Evaluation are listed with their survey results in Table 9. The data are displayed graphically in Figure 18.

TABLE 9:

RESULTS OF **TEST AND EVALUATION MANAGEMENT** PRIORITIZATION
(HIGH Xbar = HIGH IMPORTANCE)

Subarea:	Importance ($\bar{X}$)	Standard Deviation (σ)
Test & Evaluation Master Plan	1.66	0.71
DoD T&E Process	0.75	0.92
DoD T&E Policies and Directives	0.66	0.90
Contractor T&E Support	0.64	0.88
Development T&E	1.32	0.89
Operational T&E	1.32	0.89

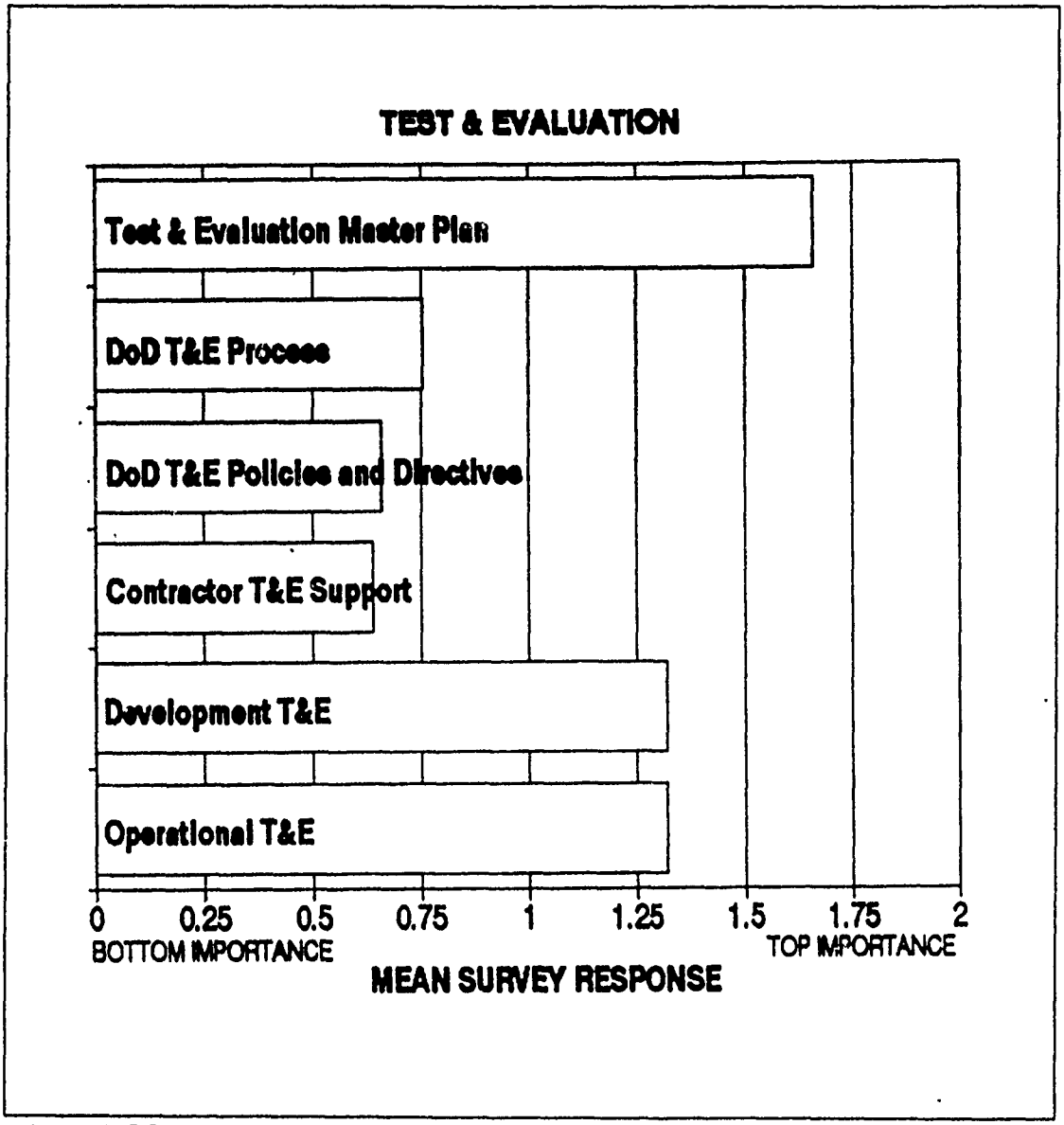

FIGURE 18: Importance of Test and Evaluation Subareas. (N=53)

Logistics Management. The Logistics Management subareas are listed with the survey results in Table 10. The data are displayed graphically in Figure 19.

TABLE 10:

RESULTS OF **LOGISTICS MANAGEMENT** PRIORITIZATION
(HIGH Xbar = HIGH IMPORTANCE)

Subarea:	Importance ($\bar{X}$)	Standard Deviation (σ)
Contracting for Logistics Support	0.55	0.77
Logistic Support Analysis	1.42	0.75
Integrated Logistic Support	1.62	0.69
Acquisition Logistics Management	1.28	0.74
Reliability/Availability/ Maintainability	1.51	0.67
Post-Production Logistic Support	0.72	0.72
Contractor Support Planning	0.51	0.70
Logistics Test & Evaluation	0.57	0.64

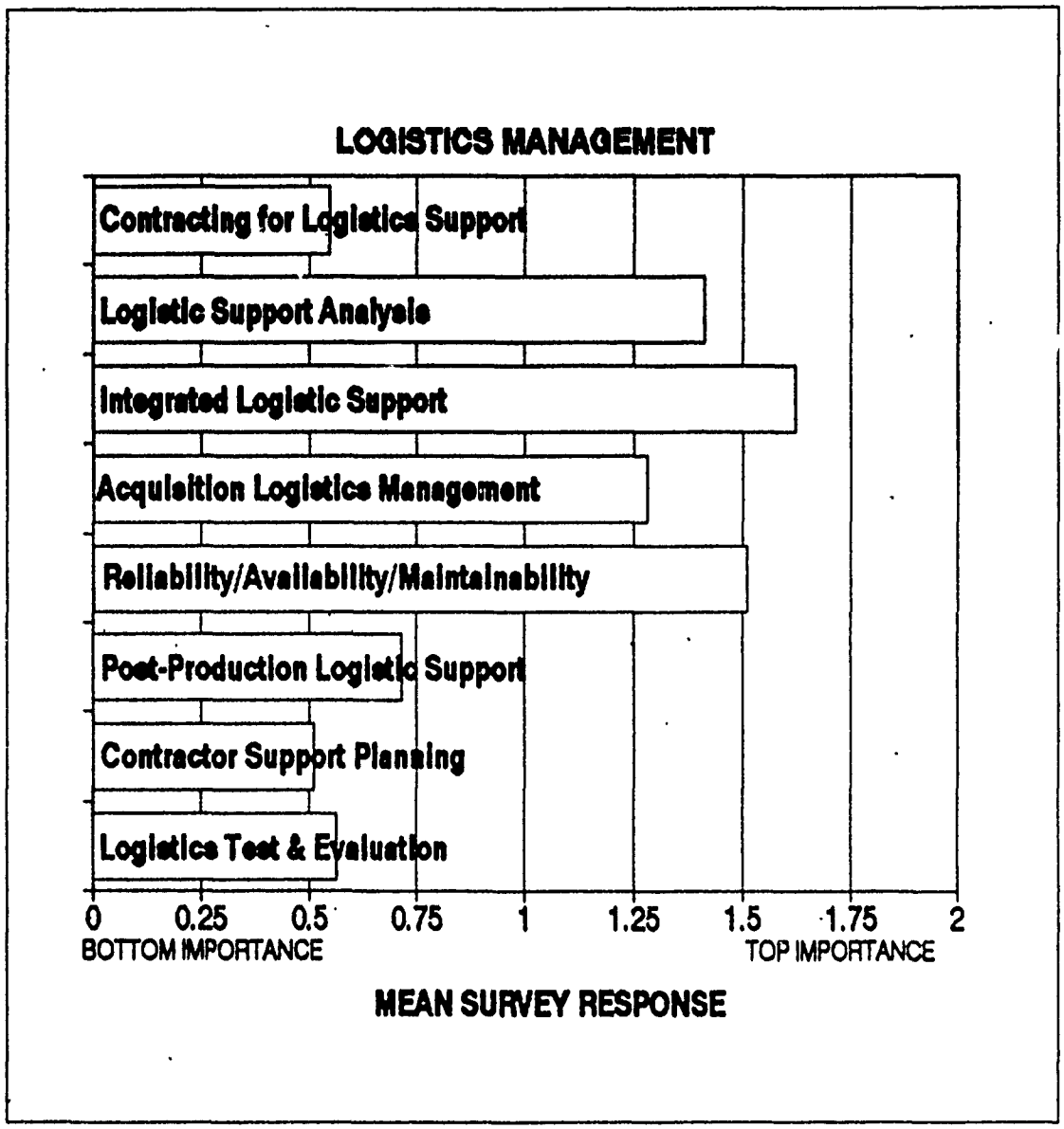

FIGURE 19: Prioritized Logistics Management S· areas. (N=53)

Manufacturing Management. The Manufacturing Management subareas are displayed with the results of the survey in Table 11. These data are displayed graphically in Figure 20.

TABLE 11:

RESULTS OF **MANUFACTURING MANAGEMENT** PRIORITIZATION
(HIGH Xbar = HIGH IMPORTANCE)

Subarea:	Importance ($\bar{X}$)	Standard Deviation (σ)
The Industrial Review Analysis	0.45	0.75
The Production Review Process	1.55	0.75
Acquisition Manufacturing Planning	1.34	0.78
Industrial Modernization Incentives	0.55	0.70
Transition from Development to Production	1.79	0.49
Manufacturing Processes	1.25	0.83
Inventory Management	0.25	0.55

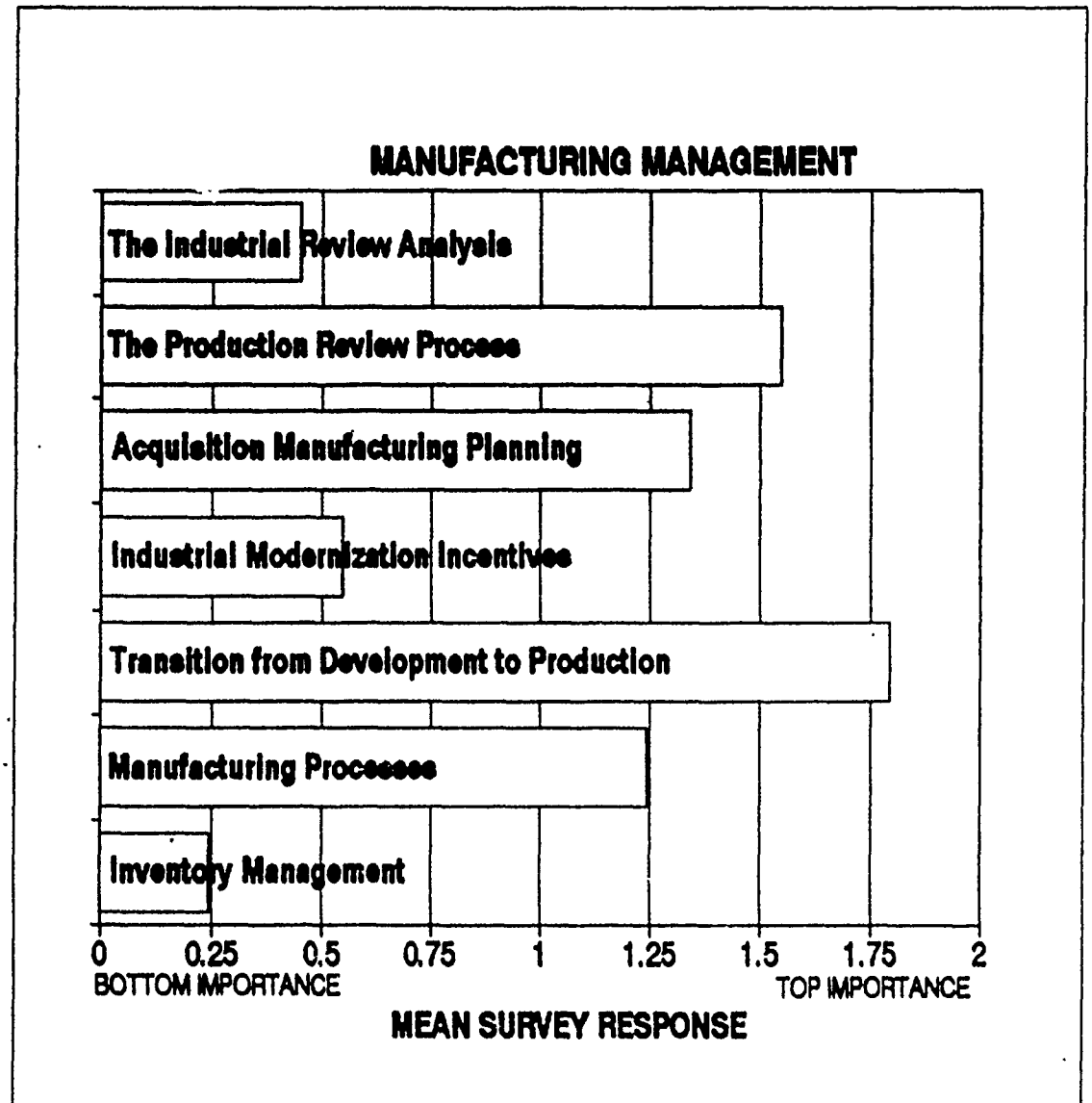

FIGURE 20: Importance of Manufacturing Management Subareas. (N=53)

Contract Management. The subareas within the Contract Management are listed with survey results in Table 12. The data are displayed graphically in Figure 21.

TABLE 12:

RESULTS OF **CONTRACT MANAGEMENT** PRIORITIZATION
(HIGH Xbar = HIGH IMPORTANCE)

Subarea:	Importance ($\bar{X}$)	Standard Deviation (σ)
Legal Aspects of Contracting	1.11	0.64
Source Selection	1.28	0.72
Contract Types	1.43	0.72
Contract Administration	1.17	0.78
Contract Modifications	1.43	0.60
Disputes and Appeals	0.81	0.68
Subcontractor/Vendor Management	0.98	0.77
Government Support to Contractors	0.51	0.50
Solicitation Methods	0.75	0.65
Problem Remedies	0.91	0.66
Warranties	0.72	0.57

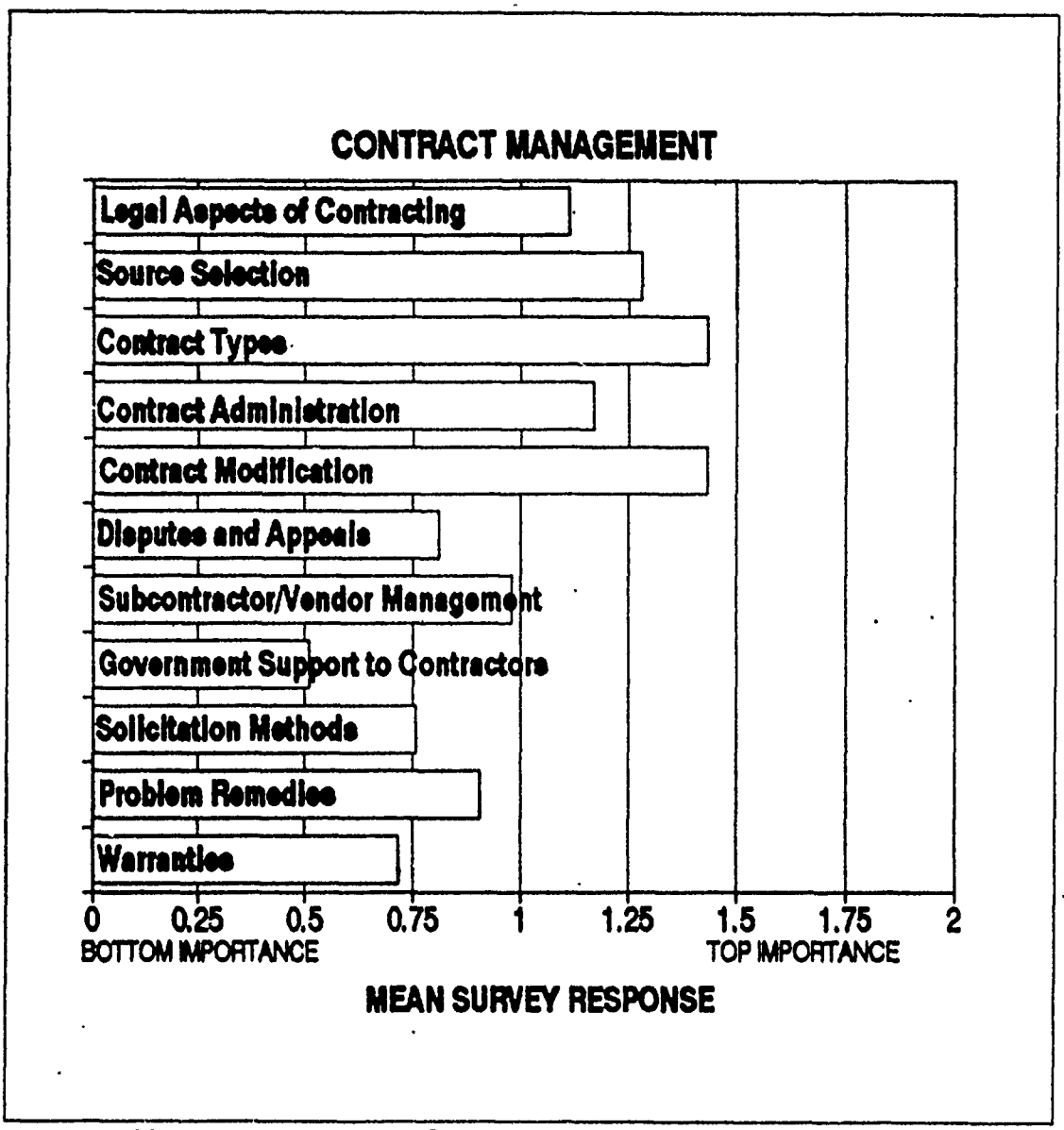

FIGURE 21: Importance of Contract Management Subareas. (N=53)

Software Management. The results of the Software Management subarea prioritization are listed in Table 13, and are shown graphically in Figure 22.

TABLE 13:

RESULTS OF **SOFTWARE MANAGEMENT** PRIORITIZATION
(HIGH Xbar = HIGH IMPORTANCE)

Subarea:	Importance ($\bar{X}$)	Standard Deviation (σ)
Software Specifications	1.00	0.68
Languages	0.17	0.43
Mission Critical Computer Resources	1.17	0.70
DoD Policies and Regulations	0.96	0.78
Software Metrics	1.02	0.80
Elements of Computer Resources	0.53	0.67
Software Maintenance	0.96	0.62
Software Acquisition	1.57	0.60
Software Documentation	1.11	0.67
Software Testing	1.43	0.60

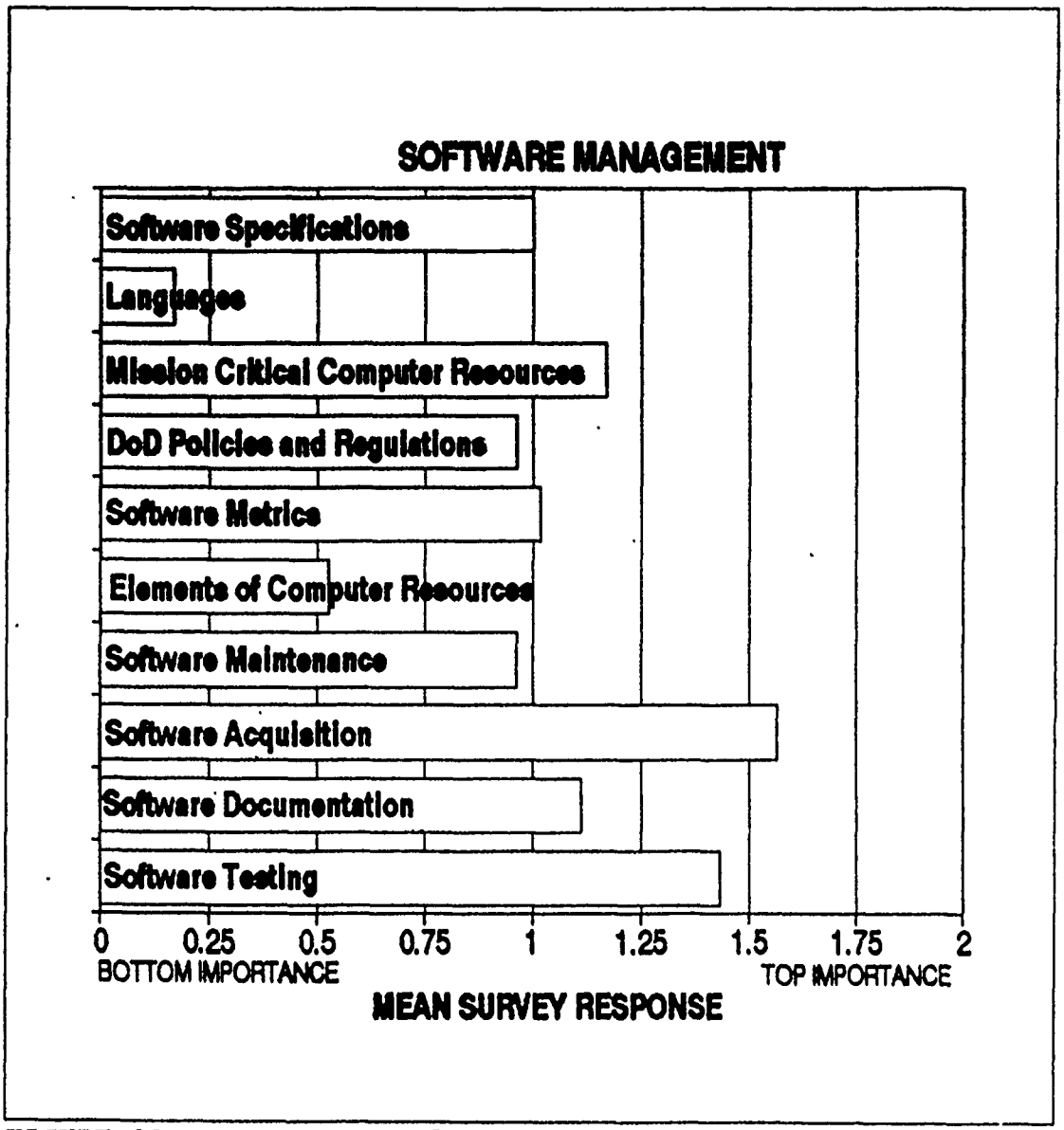

FIGURE 22: Importance of Software Management Subareas. (N=53)

Defense Program Management. The results of the prioritization of Defense Program Management subareas are listed in Table 14 and are graphically displayed in Figure 23.

TABLE 14:

RESULTS OF **DEFENSE PROGRAM MANAGEMENT** PRIORITIZATION
(HIGH Xbar = HIGH IMPORTANCE)

Subarea:	Importance ($\bar{X}$)	Standard Deviation (σ)
Federal/DoD Acquisition Policy	1.72	0.53
Federal/DoD Acquisition Organizations	0.94	0.72
International Project Management	0.57	0.72
Environmental Policy and Regulations	0.72	0.69
Management of Appropriated Funds	1.40	0.77
Contractor Perspectives on Business Management	0.72	0.72
Joint Service Acquisition Management	0.74	0.71
Role of Congress in the Acquisition Process	1.57	0.67
Competition/Alternate Sourcing	1.00	0.78

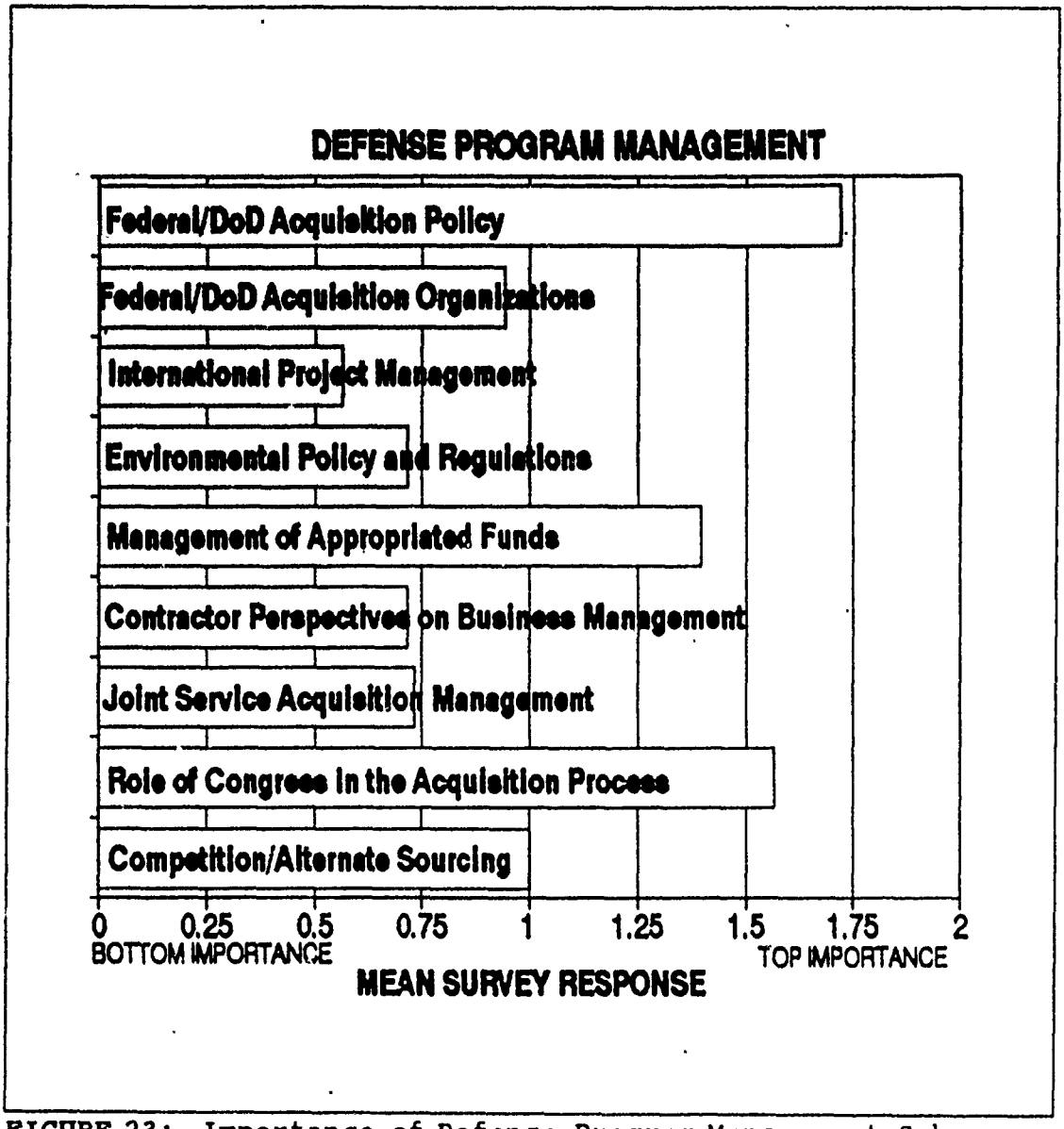

FIGURE 23: Importance of Defense Program Management Subareas. (N=53)

Additions and Deletions: No additions of major areas or subareas to the DBOK will result from the survey. No recommendations for deletion were received. A few recommendations for addition were recorded, but they were not sufficient, according to the decision rules discussed earlier in this chapter, to add any major area or subarea to the DBOK. The most common recommendations for addition, however, involved the generation of system requirements. One respondent recommended an additional major area of "Requirements," and another respondent recommended a subarea under Software Management of "Software Requirements." Other than these, no two recommendations were similar.

Part III: Training Needs. The results of the training need assessment are presented below. Table 15 shows the five subareas which accumulated the most indications as acute training need areas. The most common training method identified was "short course" for all five.

TABLE 15:

TRAINING NEEDS OF THE RESPONDENTS

Subarea (MAJOR AREA):	Number of Respondents Identifying Training Need:
Risk Assessment (RISK MANAGEMENT)	23
Cost/Schedule Control (COST MANAGEMENT)	23
Total Quality Management (QUALITY MANAGEMENT)	22
Transition from Development to Production (MANUFACTURING MANAGEMENT)	22
Federal/DoD Acquisition Policy (DEFENSE PROGRAM MANAGEMENT)	19

Part IV: Demographics. The respondents are described in terms of service, education, and experience by the following graphs. Figures 24 and 25 show the affiliation (military vs civilian) and the rank/grade distribution of all respondents, respectively. Figure 24 also illustrates the distribution between program directors and deputy program directors. Figure 26 shows the representation of each service in the survey results.

The data in Figure 26 are significant because they show that all services are represented equally in the survey data. The low representation by the Marine Corps is explained by the lower number of Major Defense Acquisition programs managed by the Marine Corps.

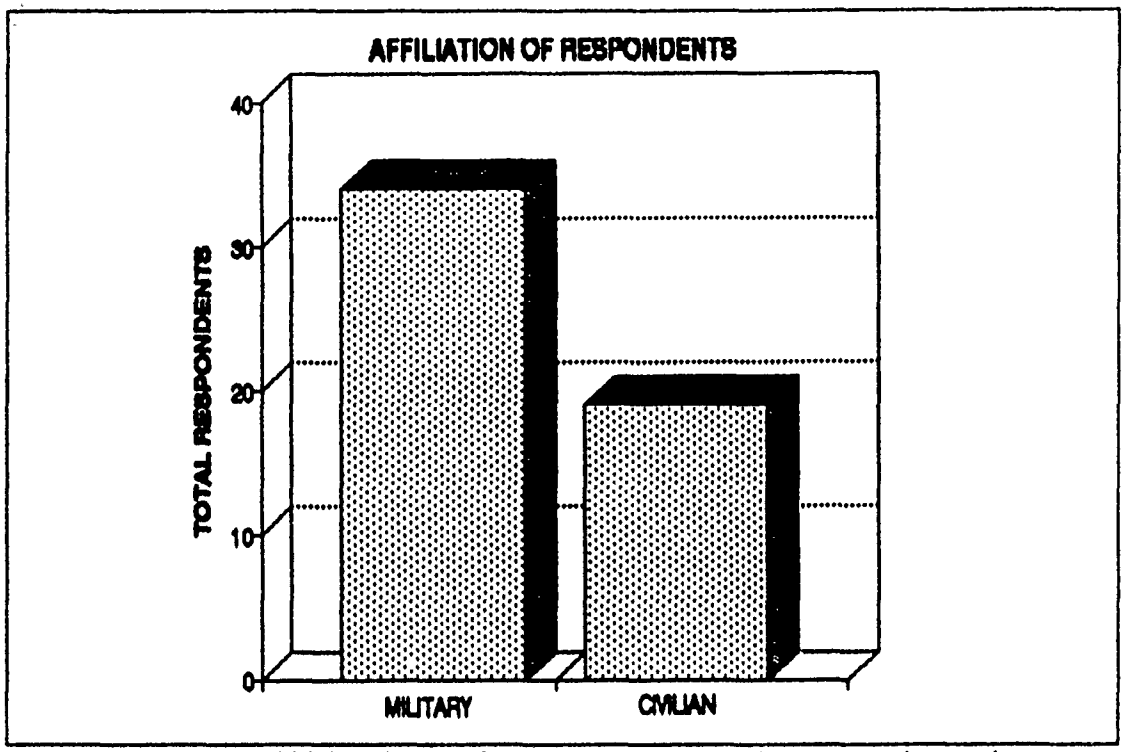

FIGURE 24: Affiliation of Survey Respondents. (N=53)

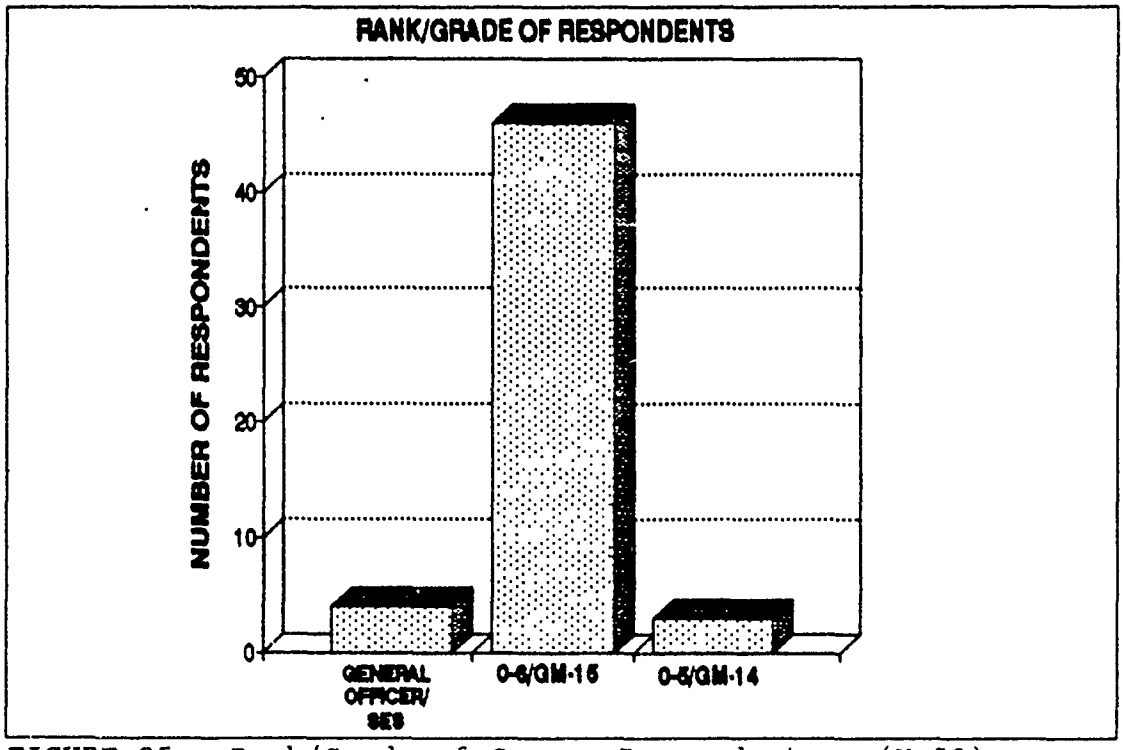

FIGURE 25: Rank/Grade of Survey Respondents. (N=53)

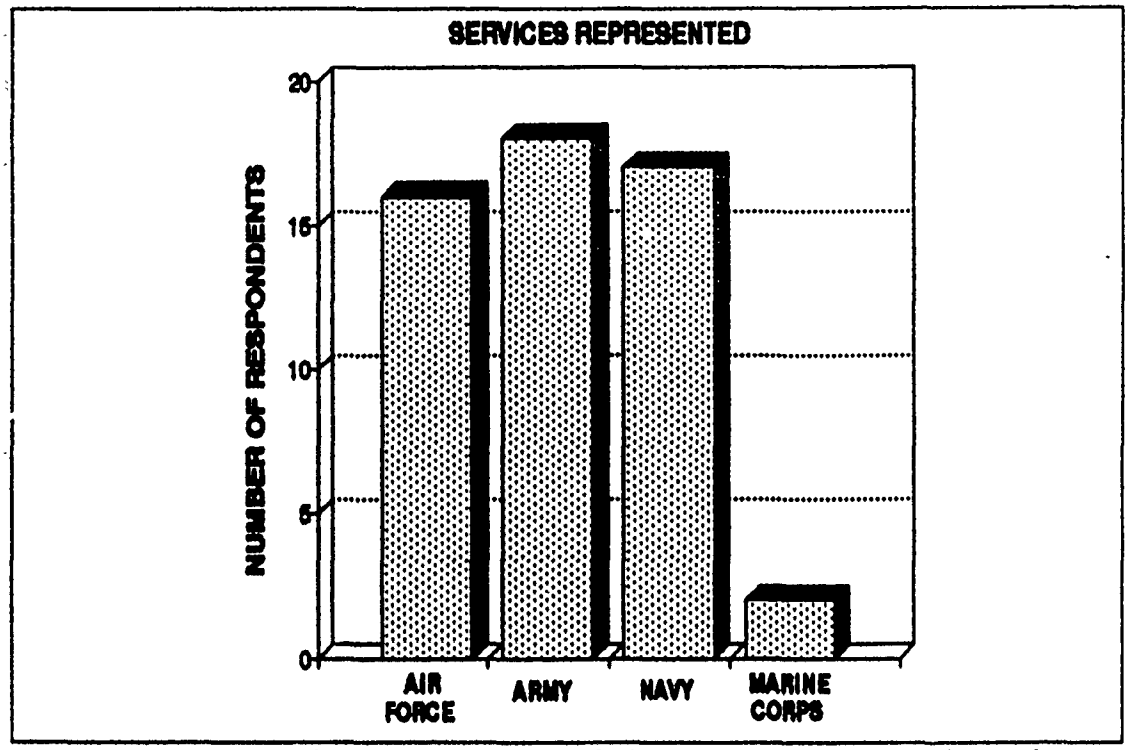

FIGURE 26: Services Represented in Survey Data. (N=53)

Figures 27 and 28 show the amount of non-acquisition experience that the survey respondents bring into the acquisition field. Figure 27 addresses operational experience (e.g., combat and combat support operations), and Figure 28 addresses staff experience (e.g., headquarters/ Pentagon experience).

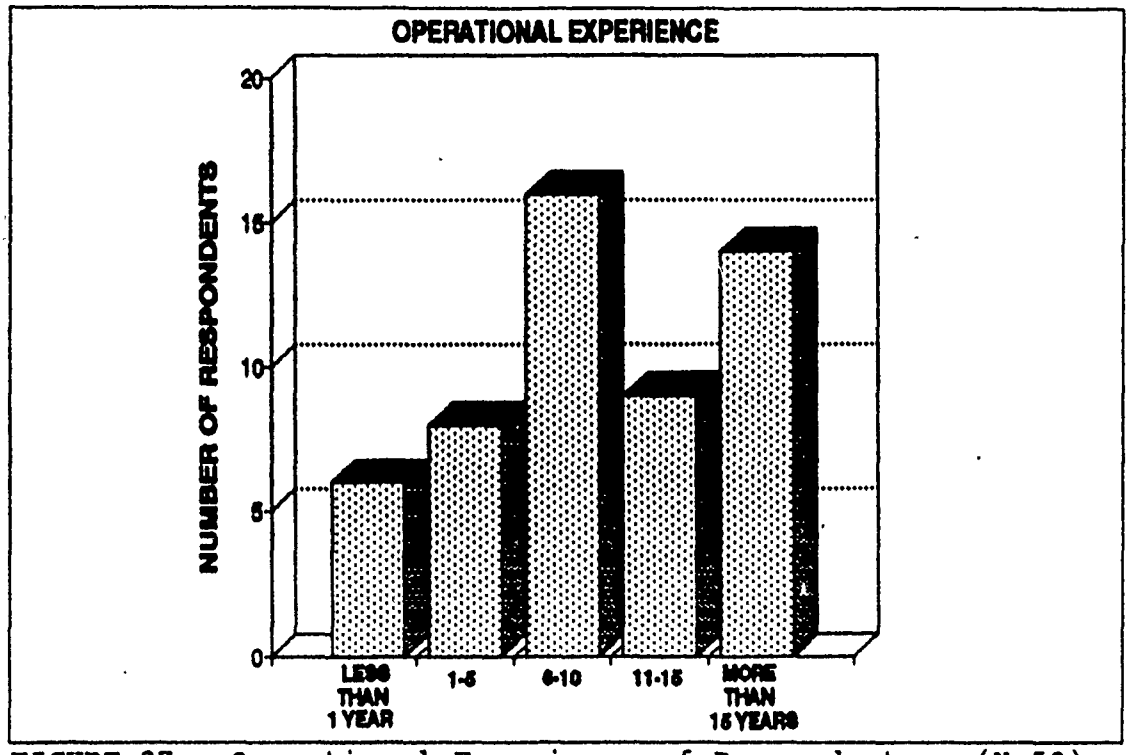

FIGURE 27: Operational Experience of Respondents. (N=53)

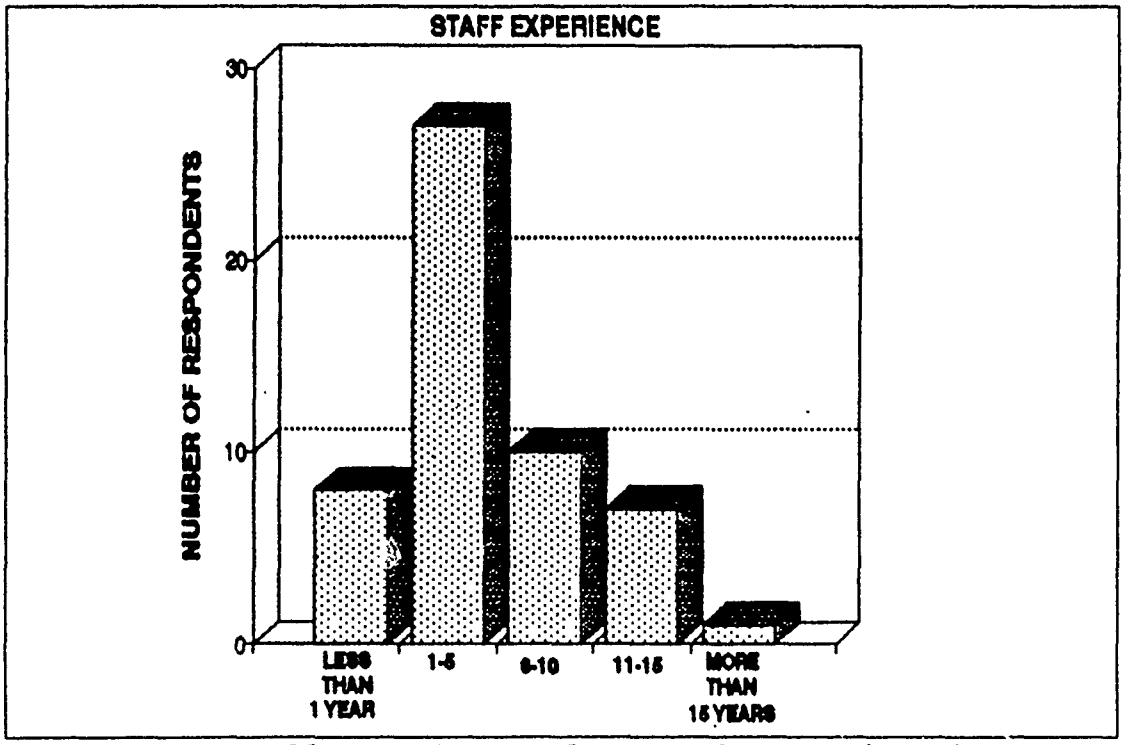

FIGURE 28: Staff Experience of Respondents. (N=53)

Figures 29 and 30 present the amount of acquisition-related experience held by the survey respondents. Figure 29 shows the amount of general acquisition experience (e.g., project manager, cost analyst, test manager).

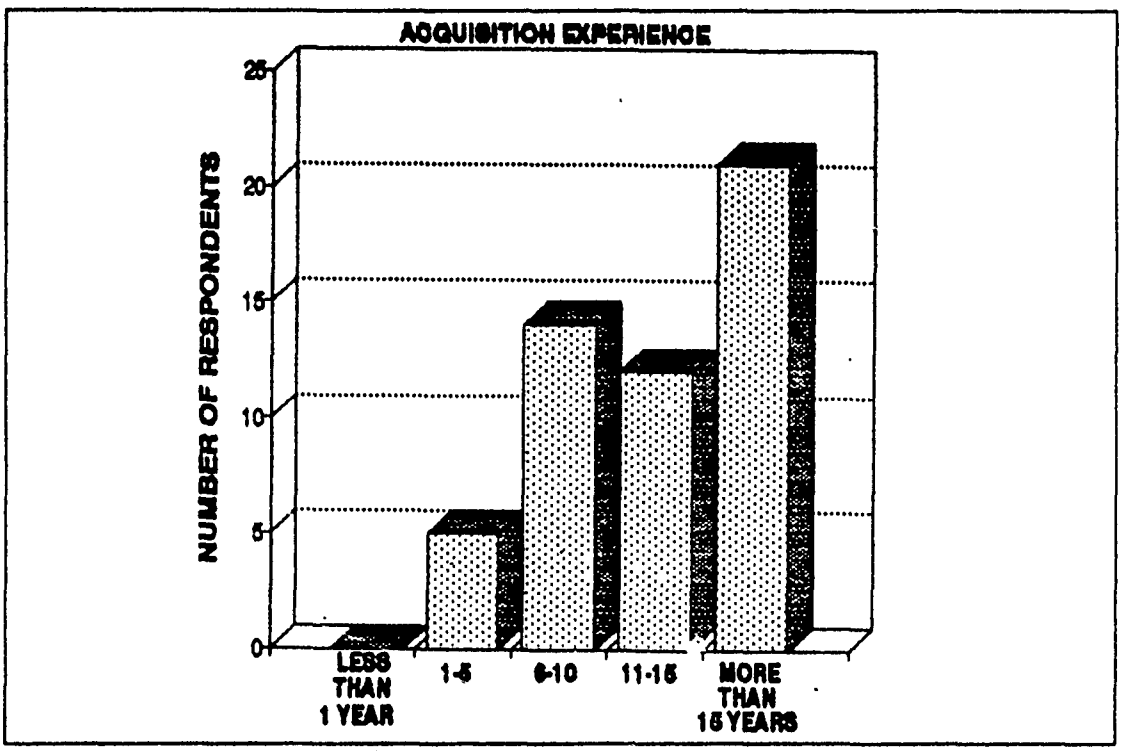

FIGURE 29: Acquisition Management Experience of Respondents. (N=53)

Figure 30 shows the amount of experience as director of a program (not necessarily a Major Defense Acquisition program).

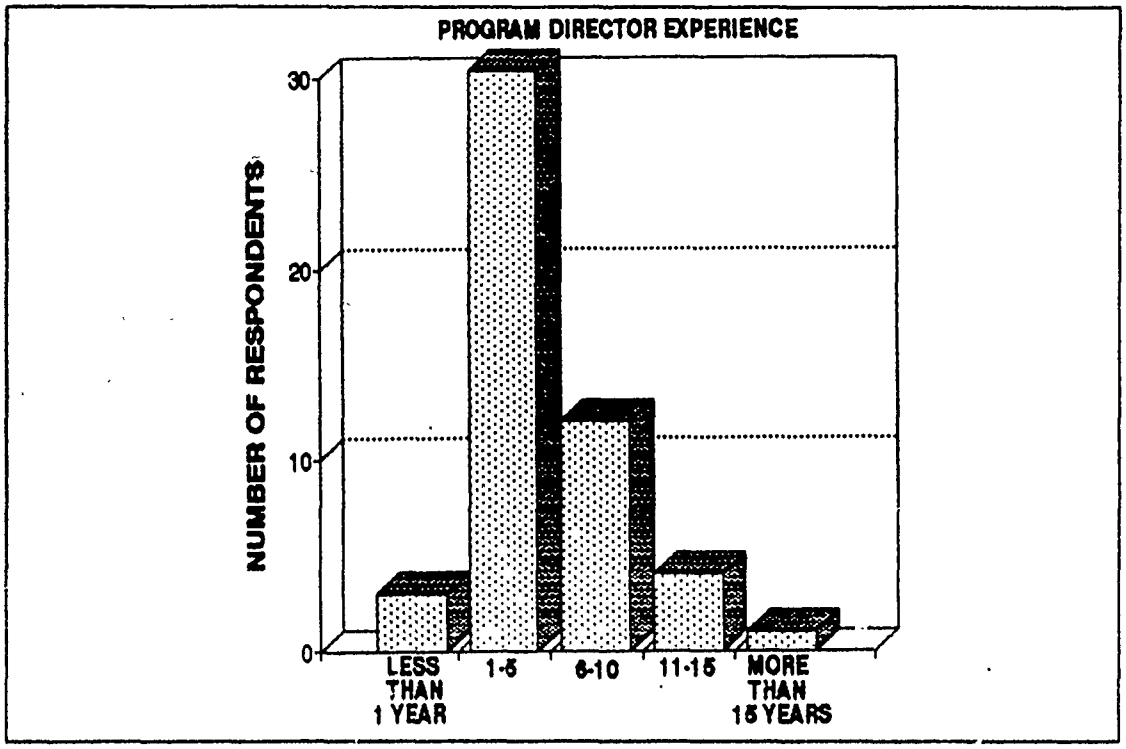

FIGURE 30: Experience as Director of a Defense Acquisition Program. (N=53)

Figure 31 shows the education of the survey respondents in terms of degrees earned and fields of education. Some respondents to this block of questions in the survey identified their *highest* degree earned without identifying preceeding degrees. This was evident when a respondent would indicate that he held a Master's degree but no Bachelor's degree, and is supported by the observation that the total Bachelor degrees indicated by Figure 31 do not sum to at least 53 (the number of respondents). The data in Figure 31, therefore, underestimate the number of Baccalaureate degrees earned by the respondents.

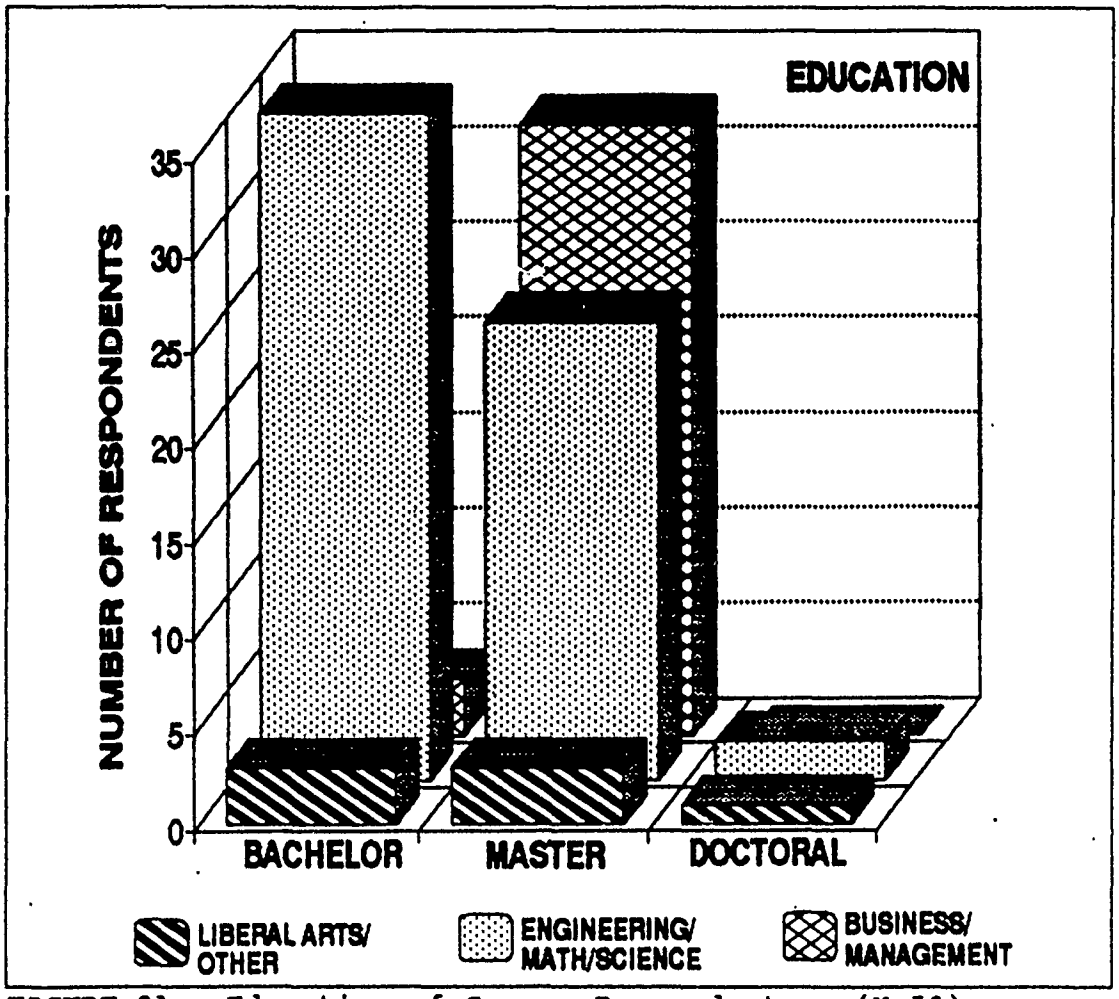

FIGURE 31: Education of Survey Respondents. (N=53)

Finally, Figure 32 shows the job satisfaction among the survey respondents; that level of satisfaction is obviously high. One respondent, however, scored himself off the scale past "extremely dissatisfied," indicating that he was highly challenged personally but "professionally frustrated with the process."

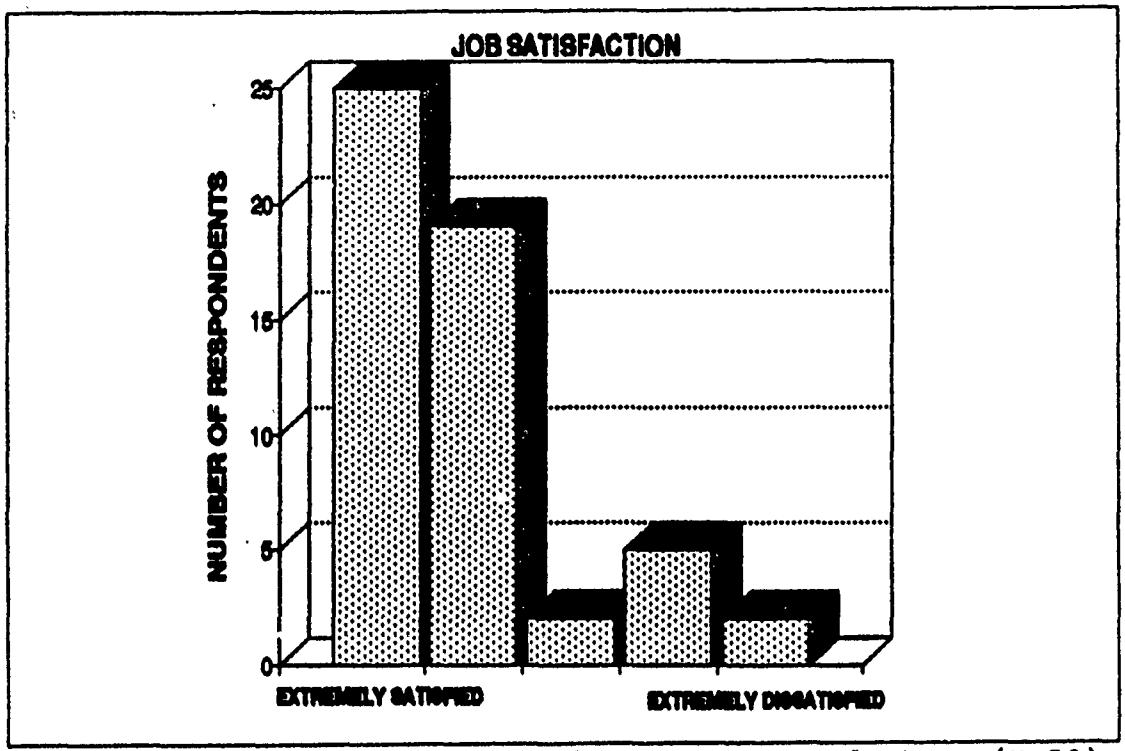

FIGURE 32: Job Satisfaction of Survey Respondents. (N=53)

V. Conclusions and Recommendations

Introduction

This section closes the research project by discussing the results of the research and what they mean to the Project Management Profession in general, and Defense Program Management in particular.

Validated Body of Knowledge

The model DBOK was validated by the population of Directors and Deputy Directors of Major Defense Acquisition Programs. This means that the DBOK produced by this research project defines the knowledge necessary for a DoD program manager to be effective.

Accreditation and Certification. As a validated, exhaustive definition and baseline of the knowledge required of a DoD program manager, the DBOK presented here is an adequate foundation for the structure of the DoD Program Management Profession. That structure would, by the definition of a profession given in Chapter II of this document, involve accreditation of educational institutions and certification of individual managers across the DoD. Furthermore, the DBOK is an adequate guide to the continuing professional development of certified DoD program managers, and would be useful as a basis for recertifying program managers.

Deficiency: Schedule Control. Based on preliminary review of this study and the DBOK by PMI leadership and DSMC, the first area of change for the DBOK should be in the area of **Schedule Control.** The DBOK as it appears in Appendix A addresses Schedule Control only indirectly through the Cost/Schedule Control and Time Management subareas (under COST MANAGEMENT and MANAGEMENT TECHNIQUES areas, respectively). More attention is required, however, in order for the DBOK to clearly identify Schedule Control as an important element of the knowledge that any effective manager brings to bear on a project. The importance of scheduling knowledge to a DoD program manager is obvious when one considers the complexity of modern weapon systems and the history of poor schedule performance for many DoD acquisition programs. Furthermore, the justification for adding an explicit reference to Schedule Control can be seen in the fact that Cost/Schedule Control is one of the two most acute training needs in the DoD today, according to the results of this survey (see Table 15).

Project Management Institute

This study will be used by the Project Management Institute upon its publication. The results of this study will be presented at the PMI annual symposium in Dallas TX in late September 1991. The goals of the research team for the symposium are as follows:

1. Present the DBOK to the PMI membership as a validated foundation of the emerging Aerospace and Defense track in PMI. The DBOK will be recommended as the basis of a professional certification program for Aerospace and Defense project managers.

2. Convince the PMI membership that the PMBOK must be re-calibrated with the Project Management Profession through a major revision, and that such a revision will be most effective if the methodology and results of this study are applied to the PMBOK.

After presentation at the PMI symposium, the results of this study will be submitted for publication in the Project Management Journal and Program Manager, DSMC's acquisition management journal.

Recommendations for Future Research

As any profession develops with time, so must its foundation and structure. The DBOK presented here is a first version that has been subjected to expert review, but it is not final nor should it be. The DBOK must be further developed and continually subjected to professional criticism to ensure that it remains valid and relevant to the profession.

Larger Project Management Profession. The profession that will grow from this DBOK will be most relevant and applicable within the DoD, but it will be, as its earlier forms always have been, a subset of the larger Project Management Profession. Recognition of this relationship by DoD program managers and project managers outside the DoD will be the conduit through which information and mutual understanding will flow to benefit the whole profession.

Appendix A: Defense Program Management Body of Knowledge (Prioritized) and Glossary

LEADERSHIP/PERSONAL SKILLS

Relationship Development and Team Building
Ethics
Personal Ownership and Commitment
Motivation and Influence
Political/Organizational Awareness/Power
Long-Term Perspective
Action Orientation
Assertiveness

STRATEGY AND PLANNING

Acquisition Strategy/Planning
Acquisition Process
Statement of Work
Project Life-Cycle Analysis
Management Information Systems
Work Breakdown Structure
Forecasting
Network Analysis

COST MANAGEMENT

Planning, Programming & Budgeting System
Cost/Schedule Control
Contractor Financial Management
Estimating
Life Cycle Cost Analysis
Reprogramming
Should Cost/Could Cost Analysis
Project Accounting
Design to Cost
Financial Analysis of DoD Contractors
Capital Investment

RISK MANAGEMENT

Risk Identification
Risk Assessment
Risk Planning
Risk Analysis
Sources of Risk
Risk Avoidance
Value Analysis
Unavoidable Risk

DEFENSE PROGRAM MANAGEMENT

Federal/DoD Acquisition Policy
Role of Congress in the Acquisition Process
Management of Appropriated Funds
Competition/Alternate Sourcing
Federal/DoD Acquisition Organizations
Joint-Service Acquisition Management
Contractor Perspectives on Business Management
Environmental Policy and Regulations
International Project Management

MANAGEMENT TECHNIQUES

Communicating
Decision Making
Organization and Staffing
Training, Developing and Retaining
Time Management
Counseling and Evaluating
Negotiating
Managing Meetings
Controlling

SYSTEMS ENGINEERING

Trade-off Analysis
Technical Performance Measurement
Configuration Management
Integrated Product Development
Technical Review Process
Engineering Change Procedures
Pre-Planned Product Improvement
Specifications and Standards
Producibility Engineering & Planning

LOGISTICS MANAGEMENT

Integrated Logistic Support
Reliability/Availability/
Maintainability
Logistic Support Analysis
Acquisition Logistics Management
Post-Production Logistic Support
Logistics Test and Evaluation
Contracting for Logistic Support
Contractor Support Planning

CONTRACT MANAGEMENT

Contract Modifications
Contract Types
Source Selection
Contract Administration
Legal Aspects of Contracting
Subcontractor/Vendor Management
Problem Remedies
Disputes and Appeals
Solicitation Methods
Warranties
Government Support to Contractors

SOFTWARE MANAGEMENT

Software Acquisition
Software Testing
Mission Critical Computer Resources
Software Documentation
Software Metrics
Software Specifications
DoD Policies and Regulations
Software Maintenance
Elements of Computer Resources
Languages

QUALITY MANAGEMENT

Total Quality Management
User/Customer Relations
Quality Assurance
Quality Evaluation Methods
Quality Controls/Standards
Quality Costs
Quality Theory

MANUFACTURING MANAGEMENT

Transition from Development to
Production
The Production Review Process
Acquisition Manufacturing Planning
Manufacturing Processes
Industrial Modernization Incentives
The Industrial Review Analysis
Inventory Management

TEST AND EVALUATION MANAGEMENT

Test & Evaluation Master Plan
Development T&E
Operational T&E
DoD T&E Process
DoD T&E Policies and Directives
Contractor T&E Support

GLOSSARY

A. STRATEGY AND PLANNING

Work Breakdown Structure: A task-oriented "family-tree" of activities which organizes, defines, and graphically displays the total work to be accomplished in order to achieve the final objectives of the project. It is a system for subdividing a project into manageable work packages, components, or elements to provide a common framework for cost/schedule communications, allocation of responsibility, monitoring and management.

Statement of Work: Description of the actual work to be performed on the project, which, when combined with the specifications, usually forms the basis for contractual agreement on the project.

Network Analysis: The use of reciprocal relationships to stabilize the project work, giving the project predictability and synergism. It shows relationships between various project tasks and events by tracking the time and cost considerations of the project.

Project Life-Cycle Analysis: The determination of how requirements, costs, and alternatives will vary throughout the life of the project.

Forecasting: The work performed to estimate future conditions, costs, and events.

Management Information System: A structured, interacting complex of persons, machines and procedures designed to produce information which is collected from both internal and external sources for use as a basis for decision-making.

Acquisition Planning/Strategy: Development of the overall approach for completing the project, including tailoring policies, organizations, contracting and management strategies to meet project needs.

Acquisition Process: The process of need determination, design, development, testing, production, deployment, logistical support, improvement, and retirement of a system.

B. QUALITY MANAGEMENT

Quality Assurance: Managerial processes that provide all stakeholders evidence to establish confidence that the quality activities are performed properly.

Total Quality Management: A strategy for continuously improving performance at every level, and in all areas of responsibility.

Quality Controls/Standards: The technical processes and procedures necessary to ensure that each stage in the life-cycle of a product is performed in conformance with the requirements and quality plans in order to ensure that quality is achieved throughout.

Quality Costs: The explicit and implicit costs of a poor quality product or process, the costs of quality programs and controls, and the management which strives to minimize the total of these costs.

Quality Theory: The concept or idea of instilling quality and reliability into each phase of project development.

Quality Evaluation Methods: The means by which quality may be measured and the means by which the effectiveness of quality programs may be tracked.

User/Customer Relations: Activities to cultivate and maintain user/customer support of the project and/or product.

C. COST MANAGEMENT

Estimating: The process of assembling and predicting the costs of a project.

Life Cycle Cost Analysis: Analyses based on the total cost of a system or item over its full life which includes research & development, investment, and operating phases, as well as final disposal.

Design-to-Cost: Tailoring the design, development and manufacturing process of the project so that the ultimate cost is equal to the amount of money available for completing the project.

The Planning, Programming, and Budgeting System: A cyclic planning and control process consisting of three distinct but inter-related phases (planning, programming, and budgeting), which sets forth, in terms of dollars, the "work plan" of all levels within DoD.

Reprogramming: The means by which appropriated funding levels are adjusted according to relative program shortfalls, surpluses, and obligation profiles.

Cost/Schedule Control: A technique to quantitatively measure project performance at a particular point in the project life-cycle. The process of monitoring, evaluating and comparing planned results with actual results to determine the status of the project cost, schedule and technical performance objectives.

Contractor Financial Management: A contractors overall management of its cashflow system to ensure that inflows exceed outflows and that the firm remains viable over time.

Financial Analysis of DoD Contractors: Tools and techniques used by OSD to analyze the financial position of defense contractors, and interpretation of the results of these analyses.

Project Accounting: The process of identifying, measuring, recording and communicating actual project cost data.

Capital Investment: Long-term financing of plant, property, and equipment.

Should Cost/Could Cost Analysis:

Should Cost: An approach to contract pricing which examines a contractor's work processes and identifies improvements that should be made to reduce inefficiencies thus lowering costs.

Could Cost: A cooperative effort between the government and the contractor, aimed at improving business methods and minimizing non-value added work.

D. RISK MANAGEMENT

Risk Planning: Forcing organized, purposeful thought towards the subject of eliminating, minimizing, or containing the effects of undesirable occurrences.

Risk Assessment: Review, examination, and judgement as to whether or not the identified risks are acceptable in the proposed actions.

Sources of Risk: The five types of risk which must be considered and managed on a project. These include technical, supportability, programmatic, cost and schedule risk.

Risk Identification: The process of identifying, classifying, and organizing all the risks likely to impact a particular project.

Risk Analysis: The mathematical examination of the nature of individual risk on the project, as well as potential structures of interdependent risk.

Risk Avoidance: Selecting the lower risk choice while still accomplishing the requirements.

Unavoidable Risk: Assessing that risk which can't be controlled and managing a program accordingly.

Value Analysis: A concerted effort to produce the end item as inexpensively as possible without any degradation in performance or quality.

E. LEADERSHIP/PERSONAL SKILLS

Personal Ownership & Commitment: Seeing oneself as the one responsible for the overall success of the program.

Motivation & Influence: The process of inducing an individual to work towards achieving the organization's objectives while also working to achieve personal objectives.

Political/Organizational Awareness/Power: Understanding and consideration of the politics and power issues associated with one's or another's actions.

Relationship Development & Team Building: Developing a sense of ownership and pride in the project among team members to help ensure that each team member works towards the group goal while achieving personal growth.

Action Orientation: Reacting to problems energetically and with a sense of urgency.

Long-Term Perspective: An orientation towards the long-term success of an endeavor.

Ethics: A set of moral principals or values that determine what ought to be done under a given set of circumstances.

Assertiveness: The inclination to bold, positive expression.

F. MANAGEMENT TECHNIQUES

Organizing and Staffing: establishing an effective organizational form and acquiring the required personnel from either within the organization or from outside sources.

Training, Developing & Retaining: The activities necessary to establish and develop competent employees, and the management necessary to keep them effective on the project and in its future.

Counseling & Evaluating: The art of providing periodic feedback to an employee concerning career plans, work requirements, and job performance.

Communicating: The process of formal and informal interactions of individuals and groups on the project team and across organizational lines.

Time Management: The function required to maintain appropriate allocation of time to the overall conduct of the project throughout the stages of it's life cycle by means of time planning, estimating, scheduling, and controlling.

Negotiating: The process of bargaining with individuals concerning the transfer of resources, the generation of information, and the accomplishment of activities.

Decision Making: The choice between alternative courses of action.

Controlling: Directing, regulating, or otherwise exercising authority or influence over a project.

Managing Meetings: Preparing for, conducting, and following up on project related meetings.

G. SYSTEMS ENGINEERING

Trade-Off Analysis: Consideration of the relationships among availability, reliability, and maintainability when making project decisions.

Technical Performance Measurement: The continuing demonstration and prediction of the degree of actual or anticipated achievement of selected technical goals or objectives of a system or part of a system thereof, together with causal analysis of the variance between actual achievements and objectives.

Technical Review Process: The assurance of timely and effective attention to the technical interpretation of contract requirements, determination of technical adequacy of existing design and evaluation of its requirements to satisfy requirements, and determination of a contractors readiness to proceed.

Producibility Engineering and Planning: The production engineering tasks and production planning measures undertaken to ensure a timely and economic transition from the development to the production phase of a program.

Engineering Change Procedures: The process necessary to justify and initiate engineering analysis, design, and final incorporation of a change to a baseline system design.

Pre-Planned Product Improvements: An acquisition concept which programs resources to accomplish the orderly and cost-effective phased growth or evolution of a system's capability, utility, and operational readiness.
Configuration Management: The engineering management process that includes configuration identification, configuration control, configuration status accounting and configuration audits

Configuration Management: Ensuring that equipment or hardware meets carefully defined functional, mechanical, and electrical requirements and that any changes in these requirements are rigidly controlled, carefully identified and accurately recorded.

System Specifications: The definitions of the functional and physical requirements of the components, subsystems, or systems which state exactly what the component, subsystem, or system is supposed to do and look like quantitatively.

Integrated Product Development: A systematic approach to the integrated, concurrent design of products and their related processes, including manufacturing and support.

H. TEST AND EVALUATION

Test and Evaluation Master Plan: A summary document which is maintained throughout the acquisition life cycle of a system to explain the entire T&E program.

DoD T&E Process: The occurrence of developmental, operational, and production acceptance test and evaluation procedures as a measure of the progress of technical and operational performance of a system as it matures during the acquisition process.

DoD T&E Policies and Directives: The information and regulations governing the conduct of DoD test and evaluation procedures.

Contractor T&E Support: Planning and providing for that contractor T&E effort which is necessary for a successful T&E program.

Development T&E: Testing that is conducted to assist the engineering design and development process and to verify attainment of technical performance specifications and objectives.

Operational T&E: Testing that is conducted to estimate a system's operational effectiveness and suitability, identify needed modifications, and provide information on tactics, doctrine, organization, and personnel requirements.

I. LOGISTICS

Contracting for Logistics Support: Those activities necessary to establish and maintain contracts for logistics support.

Logistic Support Analysis: Any analysis which results in a decision on the scope and level of logistics support.

Integrated Logistic Support: A disciplined, unified approach to the management and technical activities necessary to integrate support considerations into system design, to develop objective related support requirements, acquire required support, and provide the required support.

Acquisition Logistics Management: The process of systematically identifying and assessing logistics requirements and alternatives, analysis, and resolution of integrated logistics support (ILS) deficiencies, and the management of ILS throughout the acquisition process.

Reliability/Availability/Maintainability:

Reliability: The probability that an item can perform its intended function for a specified interval under stated conditions.

Availability: The degree to which an item is in an operable and committable state.

Maintainability: The ability of an item to be retained in a specified condition.

Post-Production Logistic Support: The activities necessary to insure all required support resources will be available for the remainder of the equipment service life.

Contractor Support Planning: Providing for future contractor support based on current expectations.

Logistics Test & Evaluation: Determining the ability of the present logistics to support the acquisition of the project.

J. MANUFACTURING MANAGEMENT

The Industrial Review Analysis: The analysis of industrial base capabilities conducted to determine the availability of production resources required to support a major system production program.

The Production Review Process: The process accomplished to help ensure successful transition from development to production.

Acquisition Manufacturing Planning: Evaluation and selection of manufacturing processes, materials, production rates, and other factors in the manufacture of an item.

Industrial Modernization Incentives: Programs used by the DoD to encourage contractors, subcontractors and vendors to make capital improvements aimed at advancing manufacturing technology, enhancing productivity, reducing life-cycle costs, and improving quality and reliability.

Transition from Development to Production: Those activities carried out throughout the acquisition life cycle which identify and minimize production risks.

Manufacturing Processes: The activities which change the form or properties of materials to give them the physical and functional characteristics which are required by the end item design.

Inventory Management: Providing for and controlling the materials and components required to support the manufacturing rate and determination of lot quantities.

K. CONTRACT MANAGEMENT

Legal Aspects of Contracting: The understanding and application of Federal laws and regulations that apply to Government contracting activities.

Source Selection: The impartial, equitable, and comprehensive evaluation of competitive proposals to ensure selection of a contractor who will meet the government's requirements at the best value.

Contract Types: The various forms of pricing or compensation arrangements between the government and contractors to ensure the equitable allocation of risk.

Contract Administration: The responsibility for insuring compliance for all contractual terms and provisions.

Contract Modifications: Changes to the contract terms and conditions that may effect price, delivery, or any aspect of performance.

Disputes and Appeals: The means by which contractors may seek legal recourse against the Government, and the means by which the Government may defend itself.

Subcontractor/Vendor Management: The management of any supplier, distributor, vendor or firm that furnishes supplies or services to, or for, a prime contractor or another subcontractor.

Government Support to Contractors: The specific, direct support to contractors which will be furnished by the government as part of a contractual arrangement.

Solicitation Methods: The various ways in which a contract may be initiated by the Government and the requirements governing the use of each.

Problem Remedies: Actions the Government may take against a contractor to correct non-performance under the terms of a contract.

Warranties: Contractual requirements that minimum quality, design, and/or performance levels will be met, and express conditions of contractor liability and remedies if these levels are not achieved.

L. SOFTWARE

Software Specifications: The precise and verifiable description of the characteristics of a software program.

Languages: The many forms of syntax, structure, and vocabulary that are used to develop software code, and the appropriate use of each.

Mission Critical Computer Resources: The acquisition of the computer systems involving intelligence activities, cryptological activities, command and control, equipment that is an integral part of a weapon or weapon system, equipment critical to the direct fulfillment of military or intelligence missions, by the project manager.

DoD Software Policies and Regulations: The software regulations and standards introduced by the US Government to force discipline and uniformity into the software development process.

Software Metrics: The prediction and demonstration of the degree of achievement of selected technical goals or objectives of a software development project or task, together with analysis of the variance between planned and actual achievements.

Elements of Computer Resources: The components of computer systems and their functions (e.g., CPU, RAM, compiler, etc).

Software Maintenance: The continuing support and upgrades necessary to keep a software item in operational condition.

Software Acquisition: Accomplishing the required technical, administrative, and management activities/ documents to acquire the required software.

Software Documentation: The set of manuals and other materials necessary for users, programmers, and support staff to effectively use and/or modify a particular software item.

Software Testing: The execution of a program to show that it works and/or to find its faults.

M. DEFENSE PROGRAM MANAGEMENT

Federal/DoD Acquisition Policy: The body of statutes, regulations, and other directives that govern DoD acquisition.

Federal/DoD Acquisition Organizations: The roles and responsibilities of organizations and people involved in DoD acquisition.

International Project/Program Management: The enhancement of defense postures with other nations through foreign military sales, memoranda of understanding/agreement, data exchange agreement/information exchange projects, industrial participation, munitions licensing and foreign weapons evaluation, and NATO cooperative testing as well as other international agreements.

Environmental Policy and Regulations: The body of direction, unique to the DoD, regarding environmental protection.

Management of Appropriated Funds: The responsibilities of those who obligate and spend funds appropriated by Congress.

Contractor Perspectives on Business Management: The understanding of management practices and concerns which do not apply directly to DoD management.

Joint Service Acquisition Management: Acquisition management utilizing the talents of, and providing benefits for, more than one DoD agency or military service branch.

Role of Congress in the Acquisition Process: Understanding the involvement of the U.S. Congress in the DoD acquisition process.

Competition/Alternate Sourcing: Knowledge and application of the set of statutes and regulations which direct full and open competition for Government procurement contracts, and consideration of alternatives to procurement for satisfying requirements.

Appendix B: Survey Instrument

The following pages are a reproduction of the survey instrument used by PMI to validate the model DBOK. The format was altered from the original for inclusion here due to type and margin requirements. The actual survey was distributed with a copy of the glossary at Appendix A; the glossary is not reproduced here.

PROJECT MANAGEMENT INSTITUTE®

"... building professionalism in project management..."

P.O. BOX 43 • DREXEL HILL • PENNSYLVANIA 19026-3190
215-622-1796 • FAX 215-622-5640 • TWX 5101002864

26 Jul 91

1. Please help us in a project that will benefit project managers in both government and industry.

2. The Project Management Institute and the Department of Defense are working together to develop a common Project Management Body of Knowledge tailored to Defense and Aerospace management. This Body of Knowledge will be used to establish or revise educational, professional development, and certification programs.

3. The Project Management Institute (PMI) is a nonprofit professional organization devoted to advancing the project management state of the art. PMI membership exceeds 8,000 worldwide and continues to grow in several industry sectors, including the DoD and its contractors.

4. Enclosed is a questionnaire that asks your opinion about specific areas of knowledge required for an individual to become a competent project manager. This survey is being mailed to all DoD major program directors/managers and deputies as well as a random sample of PMI members to gather the opinions of the experts in the field. **Your cooperation is vital** to the success of this project. The results of this study will be published in future issues of "Program Manager" and the "Project Management Journal."

5. **PLEASE TAKE A FEW MINUTES TO COMPLETE THIS SURVEY.** We have enclosed a glossary that defines the terms we use. Return the questionnaire as soon as possible in the stamped addressed envelope enclosed. Keep the glossary unless you have specific comments on how the glossary can be improved.

6. Thank you for your cooperation and concern for the profession.

CURTIS R. COOK, PhD
Chair, Aerospace/Defense Group
Project Management Institute

OWEN C. GADEKEN, PhD
Director of Educational Research
Defense Systems Management College

1. Please rank the following 13 major areas according to their importance to program manager competence, "1" being most important and "13" being least important. (Competence means the level of understanding that an experienced program manager (not necessarily the Program Director or overall Program Manager) must possess in order to be effective. For example, knowledge of a work breakdown structure means being able to generate one and use it as a management tool throughout a program. Being able to recognize one is not knowledge.)

A. ___ STRATEGY AND PLANNING: The establishment of strategies for effectively managing both the internal organizational environment and situations created by the external environment.

B. ___ QUALITY MANAGEMENT: The conscious planning, implementation and control of the policies and procedures to ensure conformance to correctly defined requirements satisfying customer needs.

C. ___ COST MANAGEMENT: Maintaining effective financial control over the project.

D. ___ RISK MANAGEMENT: The art/science of identifying, analyzing, and responding to risk factors throughout the life of a project.

E. ___ LEADERSHIP/PERSONAL SKILLS: Providing the vision and motivation for the project team to achieve success.

F. ___ MANAGEMENT TECHNIQUES: General management tools and abilities (e.g., time management, personnel management) that can be applied in any management position.

G. ___ SYSTEMS ENGINEERING: The emphasis of the various engineering disciplines required to carry out the system development process, especially in the design of the product or system; the engineering management of a total system to ascertain and maintain technical integrity over all the elements of the system.

H. ___ TEST AND EVALUATION MANAGEMENT: The management of a program to verify that a system meets specifications and demonstrates its effectiveness and suitability.

I. ___ LOGISTICS: Management of logistic support through acquisition logistics management, integrated logistic support, reliability/ availability/ maintainability, etc.

J. ___ MANUFACTURING MANAGEMENT: The technique of planning, organizing, directing, controlling, and integrating the use of people, money, materials, equipment, and facilities to accomplish the manufacturing task economically.

K. ___ CONTRACT MANAGEMENT: The function through which necessary resources (including people, plant, equipment and materials) are acquired for the project from outside commercial firms.

L. ___ SOFTWARE MANAGEMENT: Application of current policies, practices and procedures to acquire software as part of defense programs.

M. ___ DEFENSE PROGRAM MANAGEMENT: Knowledge of the unique defense industry and defense department environment to more effectively employ other project management competencies.

N. ___ OTHER:_____

_____

O. ___ OTHER:_____

_____

2. Each of the major areas from the previous page is repeated below with subcategories. Please indicate the importance of the subcategories under each major area by **placing a "T" in the spaces next to the top THREE subcategories and "B" in the spaces next to the bottom THREE subcategories.** Add other topics you feel are also important in the spaces provided. Refer to the attached glossary for term definitions.

A. STRATEGY AND PLANNING
__Work Breakdown Structure
__Statement of Work
__Network Analysis
__Project Life-Cycle Analysis
__Forecasting
__Management Information Systems
__Acquisition Strategy/Planning
__Acquisition Process
_____
_____

B. QUALITY MANAGEMENT
__Quality Assurance
__Total Quality Management
__Quality Controls/Standards
__Quality Costs
__Quality Theory
__Quality Evaluation Methods
__User/Customer Relations
_____
_____

C. COST MANAGEMENT
__Estimating
__Life Cycle Cost Analysis
__Design to Cost
__Planning, Programming & Budgeting System
__Reprogramming
__Cost/Schedule Control
__Contractor Financial Management
__Financial Analysis of DoD Contractors
__Project Accounting
__Capital Investment
__Should Cost/Could Cost Analysis
_____
_____

D. RISK MANAGEMENT
__Risk Planning
__Risk Assessment
__Sources of Risk
__Risk Identification
__Risk Analysis
__Risk Avoidance
__Unavoidable Risk
__Value Analysis
_____
_____

E. LEADERSHIP/PERSONAL SKILLS
__Personal Ownership & Commitment
__Motivation & Influence
__Political/Organizational Awareness/Power
__Relationship Development & Team Building
__Action Orientation
__Long-Term Perspective
__Ethics
__Assertiveness
_____
_____

F. MANAGEMENT TECHNIQUES
__Organizing & Staffing
__Training, Developing & Retaining
__Counseling & Evaluating
__Communicating
__Time Management
__Negotiating
__Decision Making
__Controlling
__Managing Meetings
_____
_____

G. SYSTEMS ENGINEERING
__Trade-off Analysis
__Technical Performance Measurement
__Technical Review Process
__Producibility Engineering & Planning
__Engineering Change Procedures
__Pre-Planned Product Improvement
__Configuration Management
__Specifications & Standards
__Integrated Product Development
_____
_____

H. TEST AND EVALUATION
__Test & Evaluation Master Plan
__DoD T&E Process
__DoD T&E Policies and Directives
__Contractor T&E Support
__Development T&E
__Operational T&E
_____
_____

I. LOGISTICS MANAGEMENT
__Contracting for Logistics Support
__Logistic Support Analysis
__Integrated Logistic Support
__Acquisition Logistics Management
__Reliability/ Availability/ Maintainability
__Post-Production Logistic Support
__Contractor Support Planning
__Logistics Test & Evaluation
_____
_____

J. MANUFACTURING MANAGEMENT
__The Industrial Review Analysis
__The Production Review Process
__Acquisition Manufacturing Planning
__Industrial Modernization Incentives
__Transition from Development to Production
__Manufacturing Processes
__Inventory Management
_____
_____

K. CONTRACT MANAGEMENT
__Legal Aspects of Contracting
__Source Selection
__Contract Types
__Contract Administration
__Contract Modifications
__Disputes and Appeals
__Subcontractor/Vendor Management
__Government Support to Contractors
__Solicitation Methods
__Problem Remedies
__Warranties
_____
_____

L. SOFTWARE MANAGEMENT
__Software Specifications
__Languages
__Mission Critical Computer Resources
__DoD Policies and Regulations
__Software Metrics
__Elements of Computer Resources
__Software Maintenance
__Software Acquisition
__Software Documentation
__Software Testing
_____
_____

M. DEFENSE PROGRAM MANAGEMENT

__Federal/DoD Acquisition Policy
__Federal/DoD Acquisition Organizations
__International Project Management
__Environmental Policy and Regulations
__Management of Appropriated Funds
__Contractor Perspectives on Business Management
__Joint Service Acquisition Management
__Role of Congress in the Acquisition Process
__Competition/Alternate Sourcing
_____
_____

3. We would also like to know how to improve the education and training of program managers. Please circle the subcategories below which represent your most critical training needs. Next to each circle, please indicate the training method which you feel would be the most effective. Use the following scale:

1: On the job training (OJT)
2: OJT supplemented with printed or video instruction materials
3: Short Course
4: Long-term full-time education culminating in a degree
5: Other:_____

A. STRATEGY AND PLANNING

Work Breakdown Structure
Statement of Work
Network Analysis
Project Life-Cycle Analysis
Forecasting
Management Information Systems
Acquisition Planning/Strategy
Acquisition Process

B. QUALITY MANAGEMENT

Quality Assurance
Total Quality Management
Quality Controls/Standards
Quality Costs
Quality Theory
Quality Evaluation Methods
User/Customer Relations

C. COST MANAGEMENT

Estimating
Life Cycle Cost Analysis
Design to Cost
Planning, Programming & Budgeting System
Reprogramming
Cost/Schedule Control
Contractor Financial Management
Financial Analysis of DoD Contractors
Project Accounting
Capital Investment
Should Cost/Could Cost Analysis

D. RISK MANAGEMENT

Risk Planning
Risk Assessment
Sources of Risk
Risk Identification
Risk Analysis
Risk Avoidance
Unavoidable Risk
Value Analysis

E. LEADERSHIP/PERSONAL SKILLS

Personal Ownership & Commitment
Motivation & Influence
Political/Organizational Awareness/Power
Relationship Development & Team Building
Action Orientation
Long-Term Perspective
Ethics
Assertiveness

F. MANAGEMENT TECHNIQUES

Organization & Staffing
Training, Developing & Retaining
Counseling & Evaluating
Communicating
Time Management
Negotiating
Decision Making
Controlling
Managing Meetings

G. SYSTEMS ENGINEERING

Trade-off Analysis
Technical Performance Measurement
Technical Review Process
Producibility Engineering & Planning
Engineering Change Procedures
Pre-Planned Product Improvement
Configuration Management
Specifications & Standards
Integrated Product Development

H. TEST AND EVALUATION

Test & Evaluation Master Plan
DoD T&E Process
DoD T&E Policies and Directives
Contractor T&E Support
Development T&E
Operational T&E

I. LOGISTICS MANAGEMENT

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Transition from Development to Production
Manufacturing Processes
Inventory Management

K. CONTRACT MANAGEMENT

Legal Aspects of Contracting
Source Selection
Contract Types
Contract Administration
Contract Modifications
Disputes and Appeals
Subcontractor/Vendor Management
Government Support to Contractors
Solicitation Methods
Problem Remedies
Warranties

L. SOFTWARE MANAGEMENT

Software Specifications
Languages
Mission Critical Computer Resources
DoD Policies and Regulations
Software Metrics
Elements of Computer Resources
Software Maintenance
Software Acquisition
Software Documentation
Software Testing

M. DEFENSE PROGRAM MANAGEMENT

Federal/DoD Acquisition Policy
Federal/DoD Acquisition Organizations
International Project Management
Environmental Policy and Regulations
Management of Appropriated Funds
Contractor Perspectives on Business Management
Joint Service Acquisition Management
Role of Congress in the Acquisition Process
Competition/Alternate Sourcing

4. Finally, please tell us about your position and experience by circling the best answer to each question.

A. AFFILIATION

1. MILITARY
2. CIVIL SERVICE
3. INDUSTRY

B. SERVICE

1. AIR FORCE
2. ARMY
3. NAVY
4. MARINE CORPS
5. NOT APPLICABLE

C. POSITION

1. PROGRAM MANAGER/DIRECTOR
2. DEPUTY PROGRAM MANAGER/DIRECTOR
3. PROJECT MANAGER
4. OTHER_____

D. RANK/GRADE

1. GENERAL OFFICER / SES
2. O-6 / GM-15
3. OTHER_____

How much defense management experience do you have under each category below?

D. OPERATIONAL EXPERIENCE

1. LESS THAN ONE YEAR
2. 1-5 YRS
3. 6-10 YRS
4. 11-15 YRS
5. MORE THAN 15 YEARS OPERATIONAL EXPERIENCE

E. STAFF EXPERIENCE

1. LESS THAN ONE YEAR
2. 1-5 YRS
3. 6-10 YRS
4. 11-15 YRS
5. MORE THAN 15 YEARS STAFF EXPERIENCE

F. **ACQUISITION MANAGEMENT EXPERIENCE** (includes all acquisition-related experience)

1. LESS THAN ONE YEAR
2. 1-5 YRS
3. 6-10 YRS
4. 11-15 YRS
5. MORE THAN 15 YEARS ACQUISITION MANAGEMENT EXPERIENCE

G. **PROGRAM MANAGER/DIRECTOR EXPERIENCE** (that portion of the above spent as manager/director of a program)

1. LESS THAN ONE YEAR
2. 1-5 YRS
3. 6-10 YRS
4. 11-15 YRS
5. MORE THAN 15 YEARS MANAGER/DIRECTOR EXPERIENCE

H. **EDUCATION**
Circle all appropriate responses for education completed.

	Bachelors Degree	Masters Degree	Doctoral Degree
Business	1a	1b	1c
Management	2a	2b	2c
Liberal Arts	3a	3b	3c
Engineering	4a	4b	4c
Science/Math	5a	5b	5c
Other _____	6a	6b	6c

I. **PROJECT PHASE**
Which phase is your program in now?

1. CONCEPT EXPLORATION & DEFINITION
2. DEMONSTRATION/VALIDATION
3. FULL-SCALE ENGINEERING AND MANUFACTURING DEVELOPMENT
4. PRODUCTION AND DEPLOYMENT

J. **MANNING**

How many people work in your program office?

1. Less than 50
2. 50 - 100
3. 100 - 150
4. More than 150

K. **JOB SATISFACTION**

In general terms, do you consider yourself satisfied with your job?

1. EXTREMELY SATISFIED
2. SOMEWHAT SATISFIED
3. NEITHER SATISFIED NOR DISSATISFIED
4. SOMEWHAT DISSATISFIED
5. EXTREMELY DISSATISFIED

5. Please add any comments you might have about this survey or the project we are conducting. Your inputs here and above are very important to the results of this study.

Appendix C: Summary of Respondent Feedback

This Appendix summarizes the comments entered on the questionnaire by respondents. The comments listed below were chosen for their relevance to the purpose of this research project and/or their insight into the unique demands on the director of a Major Defense Acquisition Program.

"...it is critical that we increase the management and leadership skills of our civilian base. GM-15 and personnel in Army Acquisition Corps must be educationally and professionally trained.... The days of technically skilled personnel rising to critical management positions without adequate management ability and training are passed...(Army Acquisition Corps) personnel must be elite and likewise treated as such."

- Army GM-15

"I tried working through the questionnaire but I don't think the entire approach is well-founded. On any given day the priorities could change markedly. There are too many fine gradations. Bottom line - A good PM needs to come equipped with a complete set of competencies. I don't think this approach will help you approach the truth."

- Navy Rear Admiral

"The position of PM is very much dependent on the quality of the team in your office. If your employees are always pushing their "envelope of performance," then the boss has very little to do except direct, control, make visionary comments, etc."

- Army Colonel

"You don't discuss the critical ability of being able to put up with an endless stream of watchers & critics, most of them neither knowledgeable nor competent, nor the constant turmoil of most major programs. Trust me, this is an essential ingredient in being a successful manager in DoD today."

- *Air Force Colonel*

"The real training needs are for people who are at least competent in ALL the areas. Subject matter experts are not scarce, but managers are rare as hen's teeth."

- *Army GM-15*

"...(DoD Acquisition programs are) very challenging, but (managing) more than one system (simultaneously) causes different challenges."

- *Army Colonel*

"Oversight is still overly pervasive in the DoD acquisition arena. This will continue to be true until the "doers" outnumber the "checkers" and the "checkers" are technically qualified and held accountable for their reports.

- *Navy Captain*

"I can't see a lot of value to this survey. Projects are run/ successful based on the "team's" ability to do the things listed, not just the "manager." The manager needs to be smart enough to know what a good team is but doesn't have to be the expert in anything except practical judgement, motivation, talent recognition, (and) commitment."

- *Navy SES*

"I think the answers to Question 2 (Subarea Prioritization) will change week to week as the program evolves and the latest hot rock rolls through the door."

- *Navy Captain*

"Survey seems to be well done. However, the aspects of program management that cause the problems appear to have been missed. It is my firm conviction that our problems are not with the training, ethics, experience, etc of the "acquisition corps." There is little wrong with the majors, LtC's, GM-13/14's or for that matter the PMs. The root of every problem is at the general officer, SES, appointee level. Who, for instance, was supposed to be reading the DAES report on the A-12?"

- *Army Colonel*

"Takes too long to complete...My first inclination was to toss it. Most PMs I know, myself included, wouldn't take the time to complete a survey this involved. Time Management!! Do you have any idea how many of these surveys we get in a year's time?? Too many!!"

- *Army Colonel*

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Vita

Captain Gregory D. Best was born on 12 August 1963 in Lansing, Michigan. He graduated from Morro Bay High School in Morro Bay, California in 1981 and attended Loyola Marymount University in Los Angeles, earning a Bachelor of Science in Mechanical Engineering in 1985. He was commissioned a Second Lieutenant through the Reserve Officer Training Corps and was assigned to Wright-Patterson AFB Ohio. His first tour of duty was as a Flight Test Manager in the Aeronautical Systems Division (ASD), Deputate for Tactical Systems. He was responsible for the flight test programs of various Foreign Military Sales aircraft, including the US upgrade to the Chinese F-8II. During that assignment he was chosen to participate in the first DoD inspection of the flight test center and military aircraft production facilities in the People's Republic of China. His second tour was as an Acquisition Program Manager in the Tacit Rainbow anti-radiation missile program at ASD. He was the director of Tacit Rainbow performance studies and effectiveness analyses until he entered the School of Systems and Logistics, Air Force Institute of Technology, in May 1990.

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Vita

Captain Korina L. Kobylarz was born on 2 August, 1963, in Lynne, Massachusetts. She graduated from high school in Lexington, Massachusetts in 1981 and attended the United States Air Force Academy from which she received the degree of Bachelor of Science in Electrical Engineering in May, 1986. Upon graduation she received a regular commission in the Air Force and was assigned to the National Security Agency, Fort Meade, Maryland, from July 1986 until October, 1987. In October, 1987, she was transferred to the Foreign Technology Division at Wright-Patterson AFB in Dayton, Ohio. While at the Foreign Technology Division, she attended part time classes at the Air Force Institute of Technology, School of Systems and Logistics, studying for a Masters Degree in Systems Management.

Following graduation, Captain Kobylarz will continue working at the Foreign Technology Division.

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REPORT DOCUMENTATION PAGE

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13. ABSTRACT (Maximum 200 words)

THIS RESEARCH PROJECT DEVELOPED A COMMON BODY OF KNOWLEDGE FOR THE FIELD OF ACQUISITION PROGRAM MANAGEMENT IN THE DEPARTMENT OF DEFENSE (DoD). THE DEFENSE PROGRAM MANAGEMENT BODY OF KNOWLEDGE (DBOK) IS A COMPILATION OF ALL KNOWLEDGE AREAS THAT A PROGRAM MANAGER MUST KNOW AND UNDERSTAND TO BE EFFECTIVE. THREE METHODS WERE USED TO DEVELOP A HYPOTHETICAL MODEL DBOK: 1) AN EXHAUSTIVE REVIEW OF PROJECT MANAGEMENT LITERATURE, 2) CURRICULA REVIEW OF DoD ACQUISITION MANAGEMENT EDUCATIONAL INSTITUTIONS, AND 3) EXPERT REVIEW. THE HYPOTHETICAL MODEL WAS VALIDATED WITH A SURVEY ADMINISTERED BY THE PROJECT MANAGEMENT INSTITUTE TO ALL DIRECTORS AND DEPUTY DIRECTORS OF MAJOR DEFENSE ACQUISITION (CATEGORY I) PROGRAMS IN THE DoD. OF 148 SURVEYS MAILED, 53 WERE RETURNED FOR A RESPONSE RATE OF 36%. THE SURVEY RESULTS PRIORITIZE ALL ELEMENTS OF THE DBOK AND IDENTIFY ACUTE TRAINING NEEDS OF THE RESPONDENTS. THE RESULTING DBOK IS A VALIDATED KNOWLEDGE BASELINE FOR THE ACQUISITION PROGRAM MANAGEMENT PROFESSION. AS SUCH, IT IS A SUITABLE STANDARD FOR ACCREDITING DoD PROGRAM MANAGEMENT EDUCATIONAL INSTITUTIONS THAT TEACH DoD PROGRAM MANAGEMENT, AND FOR CERTIFICATION OF PROGRAM MANAGERS ACROSS THE DoD. THE DBOK MUST NOW BE SUBJECTED TO PROFESSIONAL REVIEW AND CRITICISM TO ENSURE ITS APPLICABILITY.

14. SUBJECT TERMS
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